EFFECT OF HEALTHY LIFESTYLE EDUCATION ON MODIFIABLE RISK FACTORS OF METABOLIC SYNDROME AND HEALTH-RELATED QUALITY OF LIFE AMONG MIDDLE-AGED ADULTS IN NEKEMTE TOWN, WESTERN ETHIOPIA

BY;

ALEMU ADEBA FEYISSA

A RESEARCH DISSERTATION SUBMITTED TO THE NUTRITION AND DIETETICS DEPARTMENT, FACULTY OF PUBLIC HEALTH, JIMMA UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY (PhD) IN HUMAN NUTRITION.

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INSTITUTE OF HEALTH

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BY; ALEMU ADEBA FEYISSA

PROMOTERS:

PROFESSOR TEFERA BELACHEW (MD, MSc, DLSHTM, PhD)

Dr. DESSALEGN TAMIRU (MSc., PhD, ASSOCIATE PROFESSOR)

DECEMBER, 2023

NEKEMTE, ETHIOPIA

PROMOTORS:

Prof.dr.Tefera Belachew Lema (MD, MSc, DLSHTM, PhD) Professor of Nutrition, Nutrition and Dietetics Department, Jimma University Lead Nutrition Adviser, Building Resilience in Ethiopia(BRE);Oxford Policy Management (OPM).

Dr. Dessalegn Tamiru Adugna (MSc., PhD). Associate Professor of Human Nutrition, Head, Nutrition and Dietetics Department, Institute of Health, Jimma University, Jimma, Ethiopia. P.O.Box: 378, JU Mail: dessalegn.tamiru@ju.edu.et, orcid: 0000-0002-9534-031X.

Dean: Dr.Misra Abdulahia, Dean Faculty of Public Health, Associate Professor of Reproductive Health, Jimma University.

President: Dr. Jemal Abafita, Associate Professor of Economics, President of Jimma University.

MEMBERS OF THE JURY

Dr. Yohannes Kebede(Associate Professor) chairperson

Prof. Solomon Mekonnen external examiner

Prof. Kalkidan Hassen internal examiner

Promoter1.Professor drTefera Belachew, Nutrition and Dietetics Department, Jimma University

Promoter2. Dr. Dessalegn Tamiru, Department of Nutrition and Dietetics, Jimma University

ALEMU ADEBA FEYISSA

DISSERTATION TITLE: Effect of Healthy Lifestyle Education on Modifiable Risk Factors of Metabolic Syndrome and Health-Related Quality Of Life among Middle-Aged Adults Nekemte Town, Oromia National Regional State, Wesern Ethiopia.

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ABBREVIATIONS

AOR	Adjusted Odd Ratio
BMI	Body Mass Index
CKD	Chronic Kidney Disease
COR	Crude Odd Ratio
CSA	Central Statistics Agency
DDS	Dietary Diversity Score
DM	Diabetes Mellitus
EDHS	Ethiopia Demographic Health Survey
EQ_5D	EuroQoL 5-dimensions
FANTA	Food and Nutrition Technical Assistance
FAO	Food And Agricultural Organization
FBS	Fasting Blood Sugar
GEE	Generalized Estimation Equestions
HDL-C	High-Density Lipoprotein Cholesterol
HRQoL	Health-related Quality of Lfe
IDF	International Diabetes Federation
IM	Intervention Mapping
Kg	Kilograms
KM	Kilometers
Mets	Metabolic Syndrome
NCD	Non-Communicable Diseases
OR	Odds ratio
SDG	Sustainable Development Goals
SPSS	Statistical Package Of Social Science
TPB	Theory of Planned Behaviour
T2DM	Type two Diabetes Mellitus
WC	Waist circumference
WHO	World Health Organization
WHR	Waist to Hip Circumference Ratio

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ABSTRACT

Background: Metabolic syndrome (MetS) and associated chronic non-communicable diseases (NCDs) are likely a noticeable public health threats in the world. There is a disparity in the distribution of MetS and its health outcomes by geography, time, age, sex, physiology, and economic status of the population.

Latterly, the encumbrance of MetS and NCDs is emerging in developing countries at an alarming rate. Likewise, the burden of diseases and mortality related to NCDs is believed to have been confronting Ethiopia in the last three decades. Nowadays, a lot of work is being done on MetS, but there is a lack of concrete data on the effect of a community-based healthy lifestyle education intervention on MetS and health-related quality of life (HRQoL).

Up until now, the majority of research particularly in developing nations like Ethiopia has concentrated more on control than prevention. MetS and associated lifestyle diseases are accelerating internationally. Like in other countries, non-communicable diseases are currently the main cause of death in Ethiopia. Multimorbidity, the presence of two or more chronic non-communicable diseases in a given person affects all aspects of people's lives. Still, many people perceive it as a disease of developed countries. Especially, the perception of obesity is misapprehension in West Ethiopia. Metabolic Syndrome and obesity are increasing in Ethiopia due to several lifestyle-related factors including urbanization, increasing lifestyle changes, and the backlog of organ stunting due to malnutrition during the early life span.

Obesity and MetS prevention necessitate appropriate screening followed by education. What is healthy lifestyle education in the local language? It is termed "Barnoota Akkaataa Soona Jireenyaa Fayyaa" in Afan Oromo and "ጤናማ የአኗኗር ዘይቤ ትምህርት" in Amharic language. In Ethiopia, advanced laboratory methods of screening obesity and MetS are not accessible for routine service purposes. Early detection is the most strategic method for the identification of asymptomatic MetS risks as a major health concern of the 21st century. However, it has not yet been practiced potentially leading to a poor quality of life in Nekemte and other towns of Western Ethiopia.

Poor quality of life (QoL) is one of the major consequences of living with multimorbidity. The distributions of metabolic syndrome and its outcomes were wavered by several factors

nationwide. In recent years, a lot of work has been done on metabolic syndrome, but there is a lack of concrete data on the effect of a community-based healthy lifestyle education intervention on metabolic syndrome and health-related quality of life, as most studies hitherto focused on control rather than prevention, and remains a matter of concern, especially in the least developed countries like Ethiopia. As a result, the quality of life deteriorated at early productive age. Poor quality of life decreases the performance of work. Currently, subjective well-being has become a part of health outcome evaluation in studies and clinical practices. Quality of life is one of the important health outcome concepts that are expressed subjectively by patients. It considers all health dimensions, physical, mental, and socioeconomically.

Metabolic syndrome is a multi-factorial disorder that deteriorates human life. One or more modifiable risk factors: unhealthy diet, physical inactivity, smoking, and other unhealthy lifestyles lead to morbidity and/or mortality. Behavioural risk factors are also interrelated with physiological risk factors; because they are associated with many adverse health outcomes. Doing healthy behaviors and having a healthy lifestyle in middle adulthood is important for later life. Early detection and prevention are the most strategic methods for the identification of asymptomatic and undiagnosed NCDs; metabolic syndrome risks are one of the health concerns today; yet not practiced in western Ethiopia Towns. Though community-based healthy lifestyle education was not practiced; it intended to meet emerging needs, save lives of reproductive age, reduce the costs of hospital-based ambulatory care, and it also an input for community health workers.

Studies suggest that lifestyle interventions can reduce overweight/obesity, high blood pressure and glucose levels, and lipid profiles; but there is little information regarding the feasibility of the interventions in community settings mostly in Ethiopia. Prevention of metabolic syndrome, obesity, and quality of life improvement requires lifestyle education interventions. In Ethiopia, although there is an increase in the prevalence of metabolic Syndrome due to epidemiologic transition, there is no study that evaluated the effect of community-based healthy lifestyle education intervention.

Objective: To evaluate the effect of theory-based healthy lifestyle education on modifiable risk factors of metabolic syndrome, its distributions, and health-related quality of life among middle-aged adults in Nekemte Town.

Methods: This dissertation used a pre and post-test nonequivalent control quasi-experimental intervention study, a community-based cross-sectional study triangulated with descriptive and phenomenological qualitative studies to generate context-specific evidence. A community-based cross-sectional study was triangulated with a qualitative study at baseline.

The research project spanned eight months, starting from the beginning of 2019. We recruited the participants and collected their baseline data in the first quarter of the year. During this time, we also provided intensive lifestyle education to the intervention group through regular sessions. During the last quarter of the project, we conducted several activities to evaluate the impact of our intervention. We met with researchers. We also visited the field sites to observe the changes in the behavior and attitudes of the participants. We collected data from surveys, interviews, and focus groups in August 2019, after the intervention was completed.

Two hundred sixty-six apparently healthy middle-aged adults were recruited and sampled. An individual quasi-experimental study was conducted among 266 middle-aged adults of Nekemte Town who were randomly allocated into the intervention (n=133) and control (n=133) groups. The intervention group received a community leaders-led lifestyle education-based behavioral change approach on the Pender Health Promotion Model and routine follow-ups of the control group continued. The WHO stepwise approach was used to gather datas. A multivariable logistic and linear regression model run on the testing metabolic syndrome of populations, independent variables were significant predictors of metabolic syndrome, HRQoL and there was a significant increase in each of the theory of planned behavior(TPB) contracts. Correlation analysis was conducted to examine the relationship between the independent variable and the dependent variables. The collected data was checked, entered into Epi-info Version 3.5.3, and then transferred to SPSS version 24, and associated variables were considered at P-value<0.05.

Results: The prevalence of undiagnosed metabolic syndrome, undiagnosed diabetes, and unhealthy lifestyle among middle-aged adults in the study area was revealed by this study. Metabolic syndrome was linked to poor health-related quality of life. The baseline characteristics of the two groups were similar. The results indicated significant differences between the baseline and end line. Lifestyle diseases can create a vicious cycle without intervention. The main document contains the papers and articles from the structured dissertation phase by phase, which provide the data of the results. The dissertation was divided into phases. The first part included:

Chapter One which encompasses the introduction, hypothesis, objectives, dissertation sketch, methods and materials, and healthy lifestyles educational intervention strategies. The second phase covers the findings of the baseline of the study (Chapters 3 and 4). The third phase of the dissertation came with the main part of the study which encompasses the end-line findings of the dissertation (Chapter 5). The final phase of the dissertation was chapter six which illustrates the overall discussion, conclusions, recommendations, and future research perspectives.

Mixed-model regression approach was applied to properly deal with within- and between-subjects variance during baseline and end-line tests. Chapter 3 offers the magnitude of MetS, an association of MetS and HRQoL, healthy dietary practices, and barriers to adopting healthy lifestyle among middle-aged adults in west Ethiopia. Findings of multivariate logistic regression analyses showed that having poor HRQoL (AOR: 3.15; [95% CI: (1.81, 4.96), P=0.009]), and mobility problems (AOR: 7.53; [95%CI :(2.057, 3.747], P=0.003) were significantly associated with MetS. Likewise, being high BMI $\geq$ 25Kg/m^2 (AOR: 9.30, [95%CI (1.12, 77.37], p<0.0001) and SBP>130 mmHg (AOR: 5.67; [95%CI: (3.42, 9.09] p=0.039) more likely associated to MetS. Adults being in low-income households, unable to read and write, and having meal frequency less than three times per day were significantly associated with unhealthy diet practices (AOR: 1.59, 95% CI: [1.37, 3.21], AOR: 3.20, 95% CI: [2.04, 5.98], AOR: 1.91, 95% CI: [1.04, 2.71], respectively) (Chapter 3).

Chapter 4 presents the magnitude of newly diagnosed raised fasting blood sugar among urban residents in west Ethiopia and identifies the age group that is more likely at risk for the onset of diabetes. The mean and SD of fasting blood glucose level was 99.7(29.60 mg/dl) with (95%CL: 96.12, 103.27; p<0.0001). Age specification was associated as risk factors for diabetes among middle-aged adults in Nekemte Town.

Chapter 5 describes the effect of healthy lifestyle education on metabolic syndrome, its distributions of biomarkers, and health-related quality of life. The difference in differences in metabolic syndrome and its components between baseline and end line were compared by the intervention status. Multivariable logistic and linear regression models were used to identify the effect of the intervention neat of other predictors of metabolic syndrome and its components, respectively. Also, health-related quality of life and its domains are analyzed by Generalized estimating equations analysis. There was a significant difference (P<0.001) in the prevalence of

metabolic syndrome between an intervention (17.19%) and control groups (24.8%) on the end-line assessment. In Nekemte, HDDS was stratified using a wealth index. Accordingly, baseline HDDS and end-line HDDS (48.3%) had big differences among the intervention group.

The generalized estimating equation analyses were used to determine the effectiveness of lifestyle education on HRQoL and its domains. The mean difference in differences in waist circumference was 1 ± 1.1 (P<0.001), while that of blood pressure (BP) was 0.46 ± 3.06mmHg (P< 0.001. The findings revealed that middle-aged adults in the intervention groups had a greater HRQoL than did those in the control group at six months (ß=9.7, P<0.001) and ß=2.6, P=0.003, respectively) (Chapter 5:3). After the intervention, the mean score of knowledge, attitude, subjective norms, and perceived behavioral control in the intervention group was significantly higher than the control group and the difference was significant (p<0.001). After theory-based lifestyle education through the intensive participation of community leaders, there was a statistically significant difference in the mean BMI among the two groups (F=14.17, P<0.001) (Chapter 5:1).

Conclusions and Recommendations: Community leaders-led healthy lifestyle education through theory-based targeting of middle-aged brought acceptable adopting healthy lifestyle behaviors, reduced the prevalence of MetS, and improved physiological factors, and health-related quality of life on a community basis. This dissertation implies that educational interventions targeting age specification need intensive community leaders' engagement in designing healthy lifestyle education programs. Therefore, we recommend that policy makers, initiators, and health care workers lead and network the communities through community leaders which are used as a prominent tool to implement effectively the program, tackle lifestyle diseases, and contribute a crucial role in the achievement of sustainable development goals**.**

Keywords: *Middle-aged adults, Metabolic Syndrome, Modifiable Risks, Quality Of Life, Lifestyle Education, Health Promotion Model, Intervention Mapping, Wellness, Nekemte.*

CHAPTER 1: GENERAL INTRODUCTION

1.1. GENERAL OVERVIEW OF THE DISSERTATION

This dissertation provides a general overview of metabolic syndrome (MetS) distributions, the prevalence, metabolic risk factors, and its association with health-related quality of life; as well as possible effects of lifestyle education on adopting a healthy lifestyle, modifiable risk factors of MetS, and HRQoL among middle-aged adulthood in Nekemte Town Western Ethiopia. Chapter one presents the introduction, statement of the problem, conceptual framework, purpose, hypothesis, scopes, and significance of the study.Chapter two describes methods and materials. Chapter-3 and 4- designates baseline outcomes while chapter-5 come with end line results. Finally, the general discussion, conclusions and recommendations were presented in chapter-6.

1.2. BACKGROUND OF THE STUDY

Nowadays, metabolic syndrome (MetS) is a universal health dispute (Saklayen MG, 2018, Grundy SM, *et al*, 2009). It is characterized by abdominal obesity, dyslipidemia, hypertension, insulin resistance, and other chronic ailments (Lanktree *et al.* 2018, Falkner, B. *et al*. 2014). The magnitude of MetS is promptly increasing globally across populations (Oguz A.*et al*, 2008). In developing countries, over-nutrition is the second 'silent emergency' due to rapid urbanization and shifting of diet(Barry and Popkin, 2013).

Socioeconomic variances in health and its related mortality have amplified in the past two decades(Sassoon and Hayward 2019). Predominantly healthy lifestyles are correlated to socioeconomic status (Skalamera and Hummer,2016). The development of MetS escalated and linked to potential risks of unhealthy lifestyles (Phongsavon P. *et al*, 2010; Hung NT, *et al*, 2004). The risk of non-communicable diseases (NCDs) is known to increase by adopting modifiable risks like tobacco smoking, too much fat and energy diets, and being physically inactive(Hirakawa Y, *et al, 2016*). Self-justifying health behaviors including quitting smoking, physical activity, fruit and vegetable consumption, and avoidance of harmful alcohol help to prevent or alleviate the suffering and early mortality related to NCDs(Fisher-Hoch, S.P. *et al.*, 2015).

Living a healthy lifestyle means the way of that lowers the risk of being seriously ill or dying early(WHO, 1999). Lifestyle behaviors lie at the root of many chronic diseases and even mortality(Ford ES *et al*, 2011; Loef M &Walach H, 2012; Li. *et al*, 2011; Hoevenaar. *et al*, 2013; Martinez-Gomez . *et al*, 2013). Also, indication from other studies suggests that healthy lifestyle factors are jointly associated with mortality (Yu ZB, *et al*. 2020).

Metabolic syndrome leads to the deterioration of human life. A healthy lifestyle is a way of life that provides, maintains, and promotes the individual's health well-being, and quality of life (Zemani M *et al*., 2013). Health-related quality of life systematically measures the relationship between health and quality of life (QoL)(Aromaa A *et al*., 2006; Van Reenen M and Oppe M, 2015).

Lifestyles can be concordant comorbidities or discordant for health and well-being (Saint Onge and Krueger 2017). A positive concordant health lifestyle involves the evading of multiple, uniformly unhealthy behaviors, whereas a negative concordant health lifestyle involves the maintenance of multiple, uniformly unhealthy behaviors. Discordant health lifestyles involve a mix of healthy and unhealthy behaviors(Hummer Robert *et al*. 2017).

In the prior research, the documented constellations of behaviors imply that changes in one specific behavior may be difficult to effect without other changes to the underlying lifestyle. For example, someone entering marriage may change multiple behaviors as part of a shifting lifestyle, as this transition is associated with less substance use but also compromised diet and exercise(Ross, Hill, and Mirowsky 2016). Recent research has pointed to the usefulness of healthy lifestyles in understanding behavioral patterns (Daw, Margolis, and Wright 2017; Olson *et al*. 2017) and has demonstrated important associations with mortality and morbidity (Lawrence *et al*. 2017; Burdette *et al*. 2017; Saint O. and Krueger 2017). The outcomes of lifestyle practices among adults were measured by lifestyle assessment and lifestyle screening tools (Correia M. 2018).

Exercising a healthy lifestyle is crucial in the prevention of metabolic risk factors and health outcomes such as high blood pressure, stomach obesity, diabetes, and hyperlipidemia (WHO, 2017). However, a ration of work has been done on MetS recently there is a lack of tangible pooled data on its effect on health-related quality of life, and most studies hitherto focused on

control rather than prevention, and remains a matter of concern, especially in developing countries. Similarly healthy lifestyle education was not given to solve these problems.

1.3. STATEMENT OF THE PROBLEMS AND JUSTIFICATIONS

The Magnitude of metabolic disorders is hastily growing internationally across populations (Saklayen MG, 2018, Oguz A, *et al,* 2008). The worldwide prevalence of MetS ranges from zero percent to as much as 84% (Khan Y, et al. 2018). The risks of NCDs are known to increase by adopting unhealthy lifestyles (Khan Y, *et al*. 2018). Worldwide, Obesity poses a major public health problem (Yan Zhang *et al,* 2017). Worldwide, Obesity poses a major public health problem (Lancet. 2011; Finucane MM, *et al*, 2012; WHO, 2011&2015), and skyrockets in middle age & typically declines in the elderly (Hall *et al*, 2011). In developing countries, over-nutrition or overweight/obesity is the second 'silent emergency' due to rapid urbanization and shifting of diet(Popkin, 2011).

Mets and the distribution of its components vary in the general adult population by person, place, and time. The global prevalence was range 42.1-48.2% for ethnic-specific central obesity, 42.6% (40.3–44.9) for systolic blood pressure (BP) ≥ 130 mmHg and/or diastolic BP ≥ 85 mmHg, 40.2% (37.8–42.5) for HDL-cholesterol < 1.03 for men or < 1.29 mmol/L for women, 28.9% (27.4–30.5) for serum triglycerides ≥ 1.7 mmol/L, and 24.5% (22.5–26.6) for fasting plasma glucose ≥ 5.6 mmol/L (Jean Jacques Noubiap, *et al*. 2022).

Globally, the adult population having Metabolic syndrome ranged from 20–25%; individuals with metabolic syndrome are five times more susceptible to chronic diseases (Kassi E, *et al*. 2011; Jaggi S *et al*. 2016; Wang PC, *et al.* 2011; Fisher-Hoch SP, *et al*. 2011) and becoming an important cause of morbidity and mortality in Africa. In Sub-Saharan Africa (SSA) its prevalence will be 59% to 79% in 2030 (Mathers C. D. and Loncar D., 2002; Kassi E, *et al*. 2011; Jaggi S *et al*. 2016; Wang PC, *et al*.2011).

Several degenerative chronic diseases can be overdue, prevented, and/or managed through healthy behaviors (Deitz *et al*,2014), yet lifestyle-related health risk factors like unhealthy diet, physical inactivity, tobacco use, and alcohol consumption, are becoming increasingly prevalent in developing countries which face rapid economic and social development, urbanization and industrialization. For example, the study confirmed the effect of metabolic syndrome traits on

atherosclerosis can be reduced by increasing cardiorespiratory fitness (Physical exercise reduces arterial elasticity and arterial stiffness by 12% and 4 %, respectively) (Agbaje *et al*. 2021).

Perception of people's metabolic syndrome is tragic believing that it is a disease of affluent society. Conversely, many individuals are not categorized as obese based on body mass index (BMI) but are predisposed to metabolic disorders (Ruderman N, *et al*,1998).

Screening MetS among those non-obese individuals is assumed to be healthy and ignored (Sinaga *et al*, 2018). The research shows that normal-weight even thin individuals could have MetS, placing them at elevated risk for chronic diseases and typically associated with high BMI(Reynolds K.*et al*, 2008). Substantiation studies also suggest that an abnormal metabolic disorder, rather than a high BMI, is associated with a higher risk of diabetes and cardiovascular diseases (Fox CS, *et al*, 2006).

In Africa, the prevalence of chronic diseases is increasing at an alarming rate, for instance in sub-Saharan Africa, over 12 million people are expected to have DM, and 330,000 of these people will die from DM-related complications. Chronic diseases are now seen as global epidemics that pose a great public health challenge in Sub-Saharan Africa. In SSA, MetS accounts for 11.1%-23.9% (Charles A. *et al*., 2019) and will be 59% to 179% in 2030 (Jaggi S. *et al*., 2020). In Ethiopia, according to WHO estimation, the number of diabetics cases in the year 2000 was 800,000 and this number is expected to increase to 1.8 million by the year 2030 (Tesfaye S.*et, al*., 2009; Motala A. *et, al*.,2010). The pooled prevalence of MetS in Ethiopia from systematic reviews and meta-analysis was 34.89%(Ambachew S. *et al*., 2020), and 30% for 2021(Jemere T, and Kefale B.2021).

Sub-Saharan Africa is experiencing the fastest urbanization(Baker P. *et al*, 2020), rapid urbanization of the country leads to nutrition transitions (World Bank, 2015). According to the WHO, the effects of the nutrition transition are further exacerbated by decreased physical activity, stressful lifestyle, high alcohol consumption, and tobacco use (Nelia *et al.* 2014; Wedick, *et al.* 2012). Having one and/or more poor lifestyles affects quality of life. Population norms for health-related quality of life are an essential ingredient in health economics and the evaluation of population health(Kulanta *et al*. 2014). The effect of multimorbidity on QoL was reported to be high among middle-aged, elderly, female population groups, and individuals with comorbid mental illnesses (Freitag M, *et al*. 2014).

MetS, lifestyle-related diseases, and poor quality of life show a vicious cycle, and they are concomitant with many adverse health outcomes that need breaking the bond between them. The lifestyle changes were about twice as effective as using a Glucophage/Metformin ER 500 Mg for diabetes control (MOH, 2016). Community-based education is one of the multi-sectorial approaches to prevent lifestyle-related diseases. For successful nutrition programs, Gillespie *et al*. (1996) identify that intensive community involvement is key to program implementation. The health delivery system like poor prevention techniques, difficult work conditions, and weak healthcare infrastructure in Ethiopia faces many challenges in averting pandemics. The dietary practices of maternal and children during the first thousand days of life can influence the likelihood of developing obesity or MetS in adults.

From the above kinds of literature, the following research gaps were identified for the current study. Cohort studies have emerged in most parts of the world as a preferred tool to produce the context-specific evidence necessary to formulate guidelines aimed at preventing NCDs, yet have been not researched in West Ethiopia. The majority of papers in Ethiopia addressed the magnitude of NCDs, & MetS among adults, and most of the studies hitherto focused on control rather than prevention. Like other African countries, in Ethiopia, the prevalence of obesity and MetS lack national representation data. Regular patient briefings, early detection, and educational interventions on Mets and obesity-associated diseases were deserted or not practiced properly. Also, we identified there was a methodological gaps.

Any other research gaps were identified from different literature. Clinical trials for identification of efficient and effective new diagnostic and treatment modalities are needed to address disproportionately high burden of non-communicable diseases (e.g., diabetes) in developing countries(Alemayehu C, *et al*. 2018). For example, cohort studies have emerged in most parts of the world to formulate guidelines and conceptual frameworks, and prevent NCDs: however, still a lack of interventional research in developing countries (Nhung, *et al*. 2014, Lee *et al*. 2015), like Ethiopia. The indicators were: that large-scale clinical trials were difficult in Ethiopia (Alemayehu C, *et al*. 2018), and screening for MetS among apparently healthy individuals is ignored(Sinaga *et al*. 2018). Formulations of targeted policies and strategies needed for NCDs(Fassil Sh. et al, 2019). Also, nourishment and dietetic affront in early life brings adaptive deviations in body structure and its effect could remain throughout life cycle in Ethiopia(Arage,

et al. 2021) and backlog of organ stunting from early-life pass to adulthoods(Hassen A. *et al*, 2017).

Community-based lifestyle interventions secure communal support and have been implemented among individuals with various chronic diseases. Besides, early diagnosis of MetS and adopting healthy lifestyle help in improve the quality of community health. However, there is a lack of consolidated evidence on such approaches to prevent or manage metabolic syndrome and improve quality of life. Therefore, this dissertation was designed to evaluate the effect of lifestyle education on modifiable risk factors of metabolic syndrome, its distributions, and health-related quality of life among middle-aged Nekemte populations in Western Oromia, West Ethiopia.

1.4. CONCEPTUAL AND THEORETICAL FRAMEWORK

Currently, a variety of health promotion models have been developed to enhance knowledge in the field of health promotion (Basu S. & Goldhaber-Fiebert JD, 2015). The behavioral change approach in the HPM is a preventive approach and focuses on lifestyle behaviors that impact health. Behavioral learning includes behaviorism and social cognitive learning theory. It seeks to persuade individuals to adopt healthy lifestyle behaviors, to use preventive health services, and to take responsibility for their health.

Pender's HPM is a theoretical framework for evaluating the determinant that contributes to the promotion of healthy lifestyle behaviors and individuals' commitment to healthy behaviors (Pender NJ, 2011). This model is derived from the behaviorism and social cognitive learning theory with nine potential constructs. Individual characteristics and experience (prior behaviors) is the first scale of the HPM model to evaluate experience factors and innate factors that influence health promotion behaviors. The behavior-specific cognitions and effects are evaluated by the following constructs: perceived barriers, benefits, self-efficacy, and activity-related affect. Most HPM research focuses on these constructs to perceive the positive consequences, barriers, beliefs, and intentions to engage in a specific healthy behavior (Pender NJ, 2011, Sakraida TJ., 2013). Perceived self-efficacy is a central scale to evaluate personal capability and self-confidence in the development of healthy behaviors. The situational and interpersonal influences are the main constructs to examine the effect of social (family and friend support and interference) and environmental support (home and neighborhood) on healthy behavior (Pender NJ, 2011, Heydari A. & Khorashadizadeh F., 2014).

According to Pender, 2015, the HPM makes four assumptions: Individuals strive to control their behavior, and health professionals and Individuals work to improve themselves and their environment. According to WHO, disease prevention can be classified into the following four levels: primordial prevention (mass/individual education intervention), primary prevention (Health promotion), secondary prevention (early diagnosis), and tertiary prevention (Rehabilitation) (Tahmina Afrose, 2018, WHO, 2023). This intervention mainly focuses on primordial, primary, and secondary prevention, for the case conceptualized theoretical framework was drawn as follows:

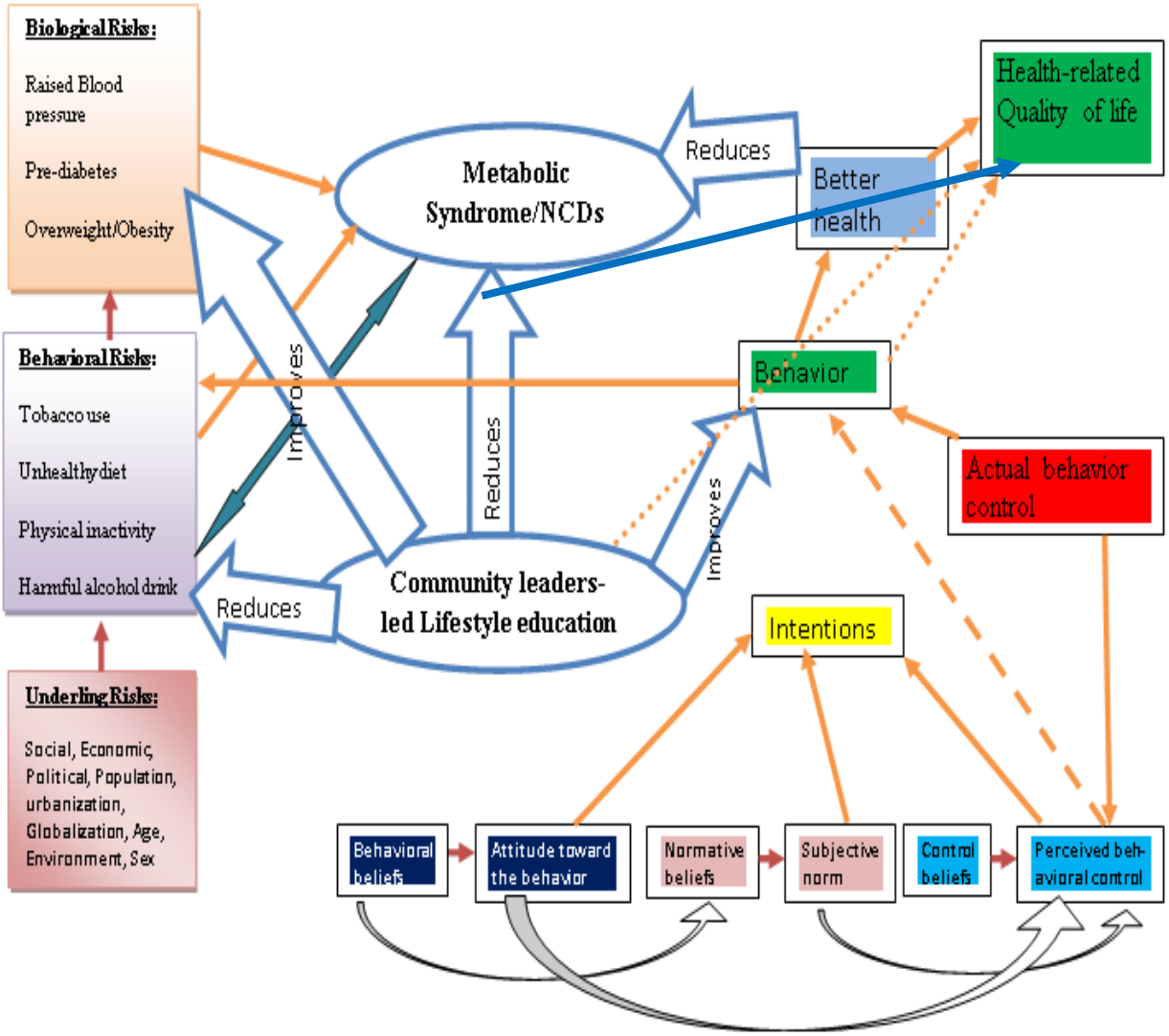


Figure 1. Conceptual framework for healthy lifestyle education, Nekemte, 2019: *Adopted from WHO, 2018 and Pender NJ,2011. Health Promotion Model Manual, 6th ed. Boston, MA: Pearson.*

1.5. SIGNIFICANCES OF THE STUDY

The dissertation plays a significant role in minimizing community mortality and morbidity. In addition, the magnitude of undiagnosed MetS, diabetes mellitus, hypertension, unhealthy lifestyles, and poor HRQoL were identified in Western Ethiopia. The current findings are an input to project the distributions of NCDs and the wealth index of the community in Ethiopia. It estimates the prevalence of MetS in the middle-aged adult population and the magnitude and determinants of the main gaps in NCD care and control. The relationship between health indicators and life quality is significantly important in clinical decisions and health policymaking and the life quality perspective is a strong stimulus for the individual's decisions and preferences. New tendence has emerged in this intervention which has led to rapid changes in the individuals' lifestyle adoption and improvement of incidences of metabolic syndrome. Community-centered adult learning is important for the retention of information and skill transfer. The study also puts a baseline for strategy developers, community health workers agencies, and stakeholders to effectively implement lifestyle education. In general, the theory-based healthy lifestyle intervention through the intensive participation of community leaders was a prominent tool in preventing chronic diseases and achieving Sustainable Development Goals in general.

1.6. HYPOTHESIS AND OBJECTIVES

1.6.1. HYPOTHESIS

Alternative hypothesis (HA):

- Middle-aged adults attending a community-based healthy lifestyle education have a lower prevalence of metabolic syndrome, central obesity and anthropometric measurements compared to the control group.
- Middle-aged adults attending a theory-based healthy lifestyle education through intensive community leaders' participantions are more likely to change their health-related behaviors in a positive sense (i.e. healthy diet, less drinking, cessation of smoking, and more physical activity) and health-related quality of life compared to the control group.
- There was a significant difference between the HPM constructs score of the intervention and control groups at the intervention test of healthy lifestyles education.

1.6.2. GENERAL OBJECTIVE

- To evaluate the effect of theory-based healthy lifestyle education on modifiable risk factors of metabolic syndrome, its distributions, and health-related quality of life among middle-aged Nekemte Populations, 2019.

1.6.3. SPECIFIC OBJECTIVES

- To determine metabolic syndrome and its association with health-related quality of life among middle-age among middle-aged urban residents of western Ethiopia, 2019.
- To assess the dietary healthy practices and associated factors among middle-aged adults Nekemte Town, 2019.
- To measure the magnitude and associated factors of undiagnosed diabetes mellitus among middle-aged urban residents of western Ethiopia, 2019.
- To explore barriers and facilitators in adopting healthy lifestyles among urban residents of West Ethiopia.
- To determine the effect of theory-based lifestyle education intervention through intensive community leaders on the intervention mapping approach to healthy lifestyle adoption.
- To evaluate the effect of healthy lifestyle education on modifiable metabolic risk factors of metabolic syndrome and health-related quality of life among middle-aged Nekemte Town, 2019.

1.7. DISSERTATION OUTLINE

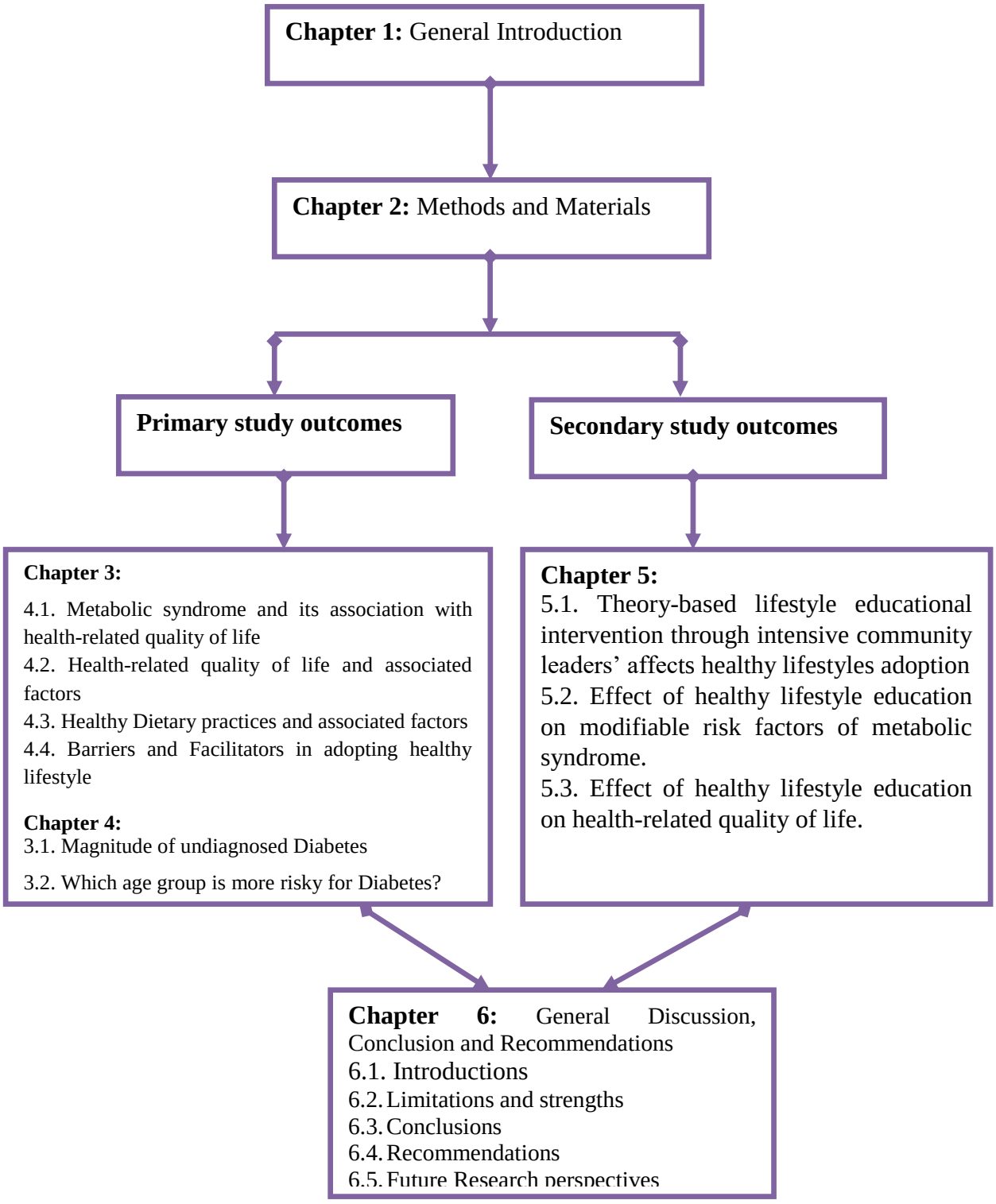


Figure 1:1 Schematic outlines of a PhD Dissertation sketch, 2023

CHAPTER 2: METHODS AND MATERIALS

2.1. STUDY AREA DESCRIPTION

2.1.1. GENERAL INFORMATION

This applied research was conducted from January 2019 to August 2019 on middle age populations at the center of western Ethiopia towns. Accordingly, Nekemte Town is selected purposively and it is one of the zonal cities of the Oromia regional state located 328 km west of Addis Ababa (Finfinne). Nekemte is at the center of the road network in south-west and north-west of Ethiopia.

Nekemte Town is one of the oldest towns in the country, established in the mid-19th century. However, it is highly underdeveloped as a function of low attention given to its development by successive regimes. Among other things, the development of the town's trade and industry is found at a very infant stage. Nekemte town is characterized by mutually contributing socio-economic problems. Ever ever-increasing rate of population pressure from excessive migration, income shortage, urban poverty, unemployment, and strikingly high and ever-increasing HIV/AIDS prevalence rate are among the town.

Nowadays, due to rapid urbanization, the total estimated population of Nekemte Town in 2022 will be 148,613(CSA, 2021). Of this, the population (permanent residents) of adults aged 40 to 65 years was 31,657 people (BDEEX USA 2019-2023).

2.1.2. CLIMATE CONDITIONS

The Nekemte Town has a mild highland subtropical climate. The average annual temperature is 18.3 °C (high: 24 °C and low: 12.6 °C), although to the north of the Equator March is the warmest month, and July is the coldest month. With more than 2080 mm, it is one of the rainiest places in the country, with most of that rain occurring in the summer. Nekemte is on an imaginary line where western winds give way to eastern ones (Fazzini. *et al*.2015). It is one of the seven rainiest cities in the country (Lemma, Melesse, 2013). From about 2007 to 2017, a nearby meteorological station showed an average annual temperature that, though lower than that from 1990, was still higher than in 1970, when rigorous recordkeeping began there, as well as greater precipitation than that seen in the 1980s (Abebe, Gezahegn,2017).

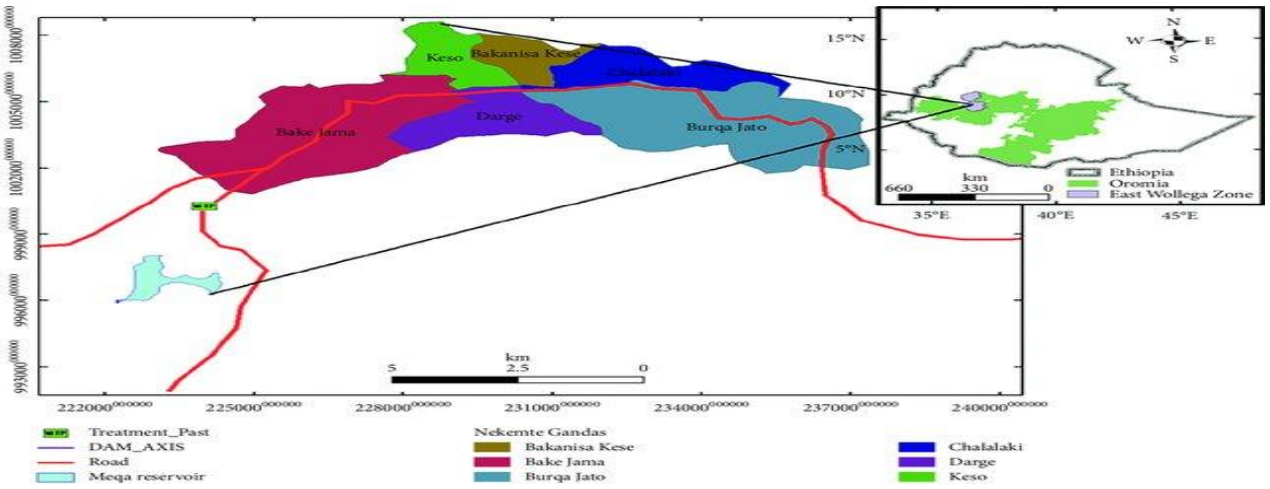


Figure 2:1 Map of Nekemte Town Gandas, 2019.

2.2. STUDY DESIGN

These were community-based cross-sectional, qualitative study and a pre-test and post-non-equivalent control quasi-experimental design conducted in two suburban communities in Nekemte Town to evaluate the effect of community-based healthy lifestyle education among middle-aged Nekemte dwellers in 2019.

2.3. SOURCE POPULATION

Nekemte is the largest Town in west Ethiopia. It has six sub-cities/kebeles/Gandas/communes, and the intervention was implemented in two Gandas'. All middle-aged adults in Nekemte Town in 2019 are our target population. The study populations were all candidates of the study in two communes/Gandas while the sample populations were the selected adults.

2.4. ELIGIBILITY CRITERIA

2.4.1. INCLUSION

This study is unique from other studies done previously by selecting healthier adults in the sample. All participants were eligible if they lived or worked within the selected communities six months before the actual study and planned to live six months in Nekemte after being recruited, aged groups (40-65 years old), and had no contraindications to participate in physical activity.

2.4.2. EXCLUSION

The exclusion criteria included: those who had a known clinical history of NCDs, were involved in a weight management program, took any herbal medications to reduce weight, had psychological disorder, and had difficulty to take healthy style education.

2.5. SAMPLE SIZE DETERMINATIONS

We determined the sample size for each objective of the study and the highest sample size was taken for the study. Accordingly, the sample calculated for blood pressure using assumed a modest correlation of r = 0.2; the SD for the follow-up measure after adjusting for the baseline value was calculated as 9.6 × the square root of (1-0.22) = 9.406. These values were entered into the G-power version (3.1.9.7) to calculate the sample size for a one-sided/tail, with a type-I error rate of 0.01. Accordingly, 112 subjects were allocated in each group to achieve 80% power to detect a difference of 3 mmHg in systolic BP in the entire sample during follow-up. Assuming a 42 dropout rate of follow-up (19%), finally the total number of participants was calculated as 266 (133 per group), with reasonable costs. The same sample size was determined using Gpower 3.1.9.7 software with the following assumption for the detection of the difference between two independent means with an effect size of 0.4 for abdominal obesity (the commonest component of MetS with 19.6% prevalent among apparently healthier Ethiopian middle-aged adults, (GirmaB, et al.2011), standard deviations (σ=2), power of 81%, with the ratio of intervention to control of 1:1. Consider the proportion exposed in the control group is 30%, after adding ~62 for loss to follow-up the final sample size became 266. This result was equivalent to 19.6% prevalence, margin of error of 0.05, 95%CI and 10% follow-up. Also, the size of the study population is based on the primary outcome of type 2 DM and is estimated at 7% in Ethiopia. So, with 80% Gpower, α=95%, π1=0.07 and π2=0.059 because there should be at least 15% of difference between controls experimental arms, N= (1.96+0.8)2(0.07(1-0.07) +0.059(1-0.059)) $\big/$ (0.07-0.059)2 =126.16≈127 in each wing. After adding 10%, the total sample size was 266.The Consolidated Standards of Reporting Trials (CONSORT) of participants' presented in flow diagram below (Fig.2:2).

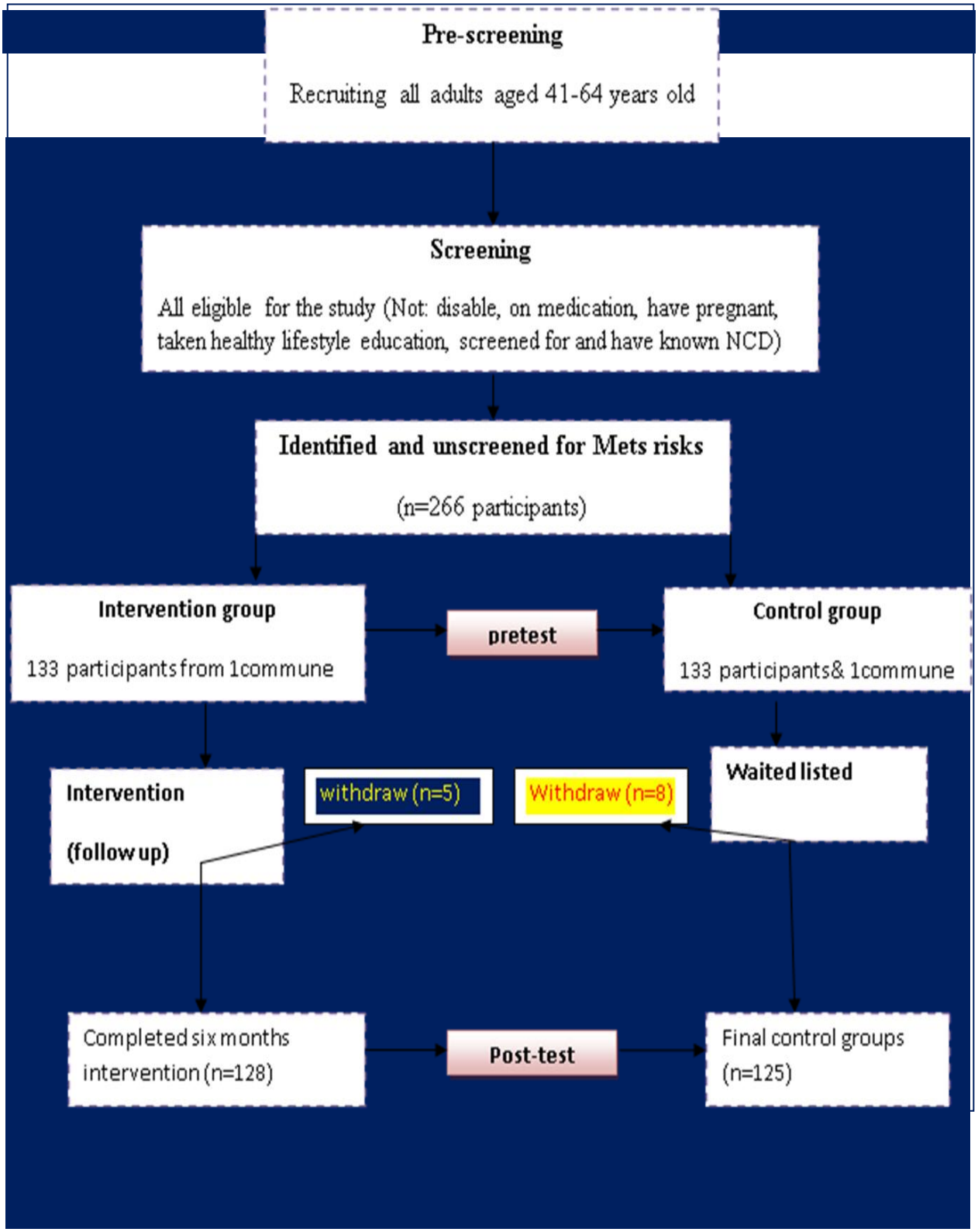


Figure 2:2. Show participant flow diagram through the intervention, Nekemte, 2019**.**

2.6. SAMPLING DESIGN

The sampling frame of this dissertation was all residents among middle-aged adults in Nekemte town during the study time included. Mixed-sampling techniques were applied (Kaur M. 2016).

The most basic of these quasi-experimental designs is the nonequivalent comparison groups design (Rubin & Babbie, 2017). A pre-test and post-non-equivalent control quasi-experimental design was applied to evaluate the change because of education between the intervention and control group on metabolic syndrome and its modifiable risks among middle-aged urban residents.

The kebele or Ganda candidate for intervention was selected with random sampling techniques and one Ganda was purposively allotted. Accordingly, out of six Gandas/kebeles, Ganda Chalalaki was randomly selected and assigned to intervention and the Burka Jato community was for control. A cohort of randomly selected adults was followed for six months and data on the outcome was collected at baseline and end line.

Sampling was done equally for the control and intervention groups using a simple random sampling technique. Study participants were registered under a specific code but were not informed of their group assignment and thus were unaware of differences between the intervention and control groups. Study participants were randomly assigned to intervention and control groups at an individual level. The list of participants and their codes are kept only by the researcher. All groups or kebeles of study participants were buffered through geographically separated to avoid the risk of information contamination.

2.7. MEASUREMENTS OF THE VARIABLES

2.7.1. DEPENDENT VARIABLES

Dependent variables in this study included: metabolic syndrome, BMI, WC, DDS, TGs, HDL-C, blood glucose, blood pressure, and health-related quality of life status.

2.7.2. INDEPENDENT VARIABLES

The independent variables were the healthy lifestyle education intervention that consists of the following: lifestyle education, healthy eating practices, physical activities, reduction in excess

alcohol drinking and cessation of cigarette smoking; lipid and serum profiles, anthropometric measurements, demographic characteristics, components of MetS, and Q-5D index score,.

2.8. STUDY OUTCOMES

2.8.1. PRIMARY OUTCOMES

- Magnitude of metabolic syndrome
- Magnitude and associated factors of undiagnosed diabetes mellitus
- Prevalence of healthy dietary practices
- Status of Health-related Quality of life
- Barriers and facilitators in adopting healthy lifestyle

2.8.2. SECONDARY OUTCOMES

- Adopting healthy lifestyle
- Reduction of distribution of the prevalence of metabolic syndrome
- Improved health-related quality of life

2.9. INTERVENTION STRATEGIES

The intervention group received healthy lifestyle education using a holistic approach. The intervention was implemented for a total of six months and effectiveness was measured by comparing control and intervention groups. The 6 months intervention program consisted of two parts; the first three months of the active period and the next three months of the maintenance period. The intervention implementation was assessed by process evaluation. A cohort of randomly selected adults was followed up for six months. The effectiveness of the intervention was measured after six months of intervention by comparing control and intervention groups based on primary and secondary outcome measures (Fig.2:3).

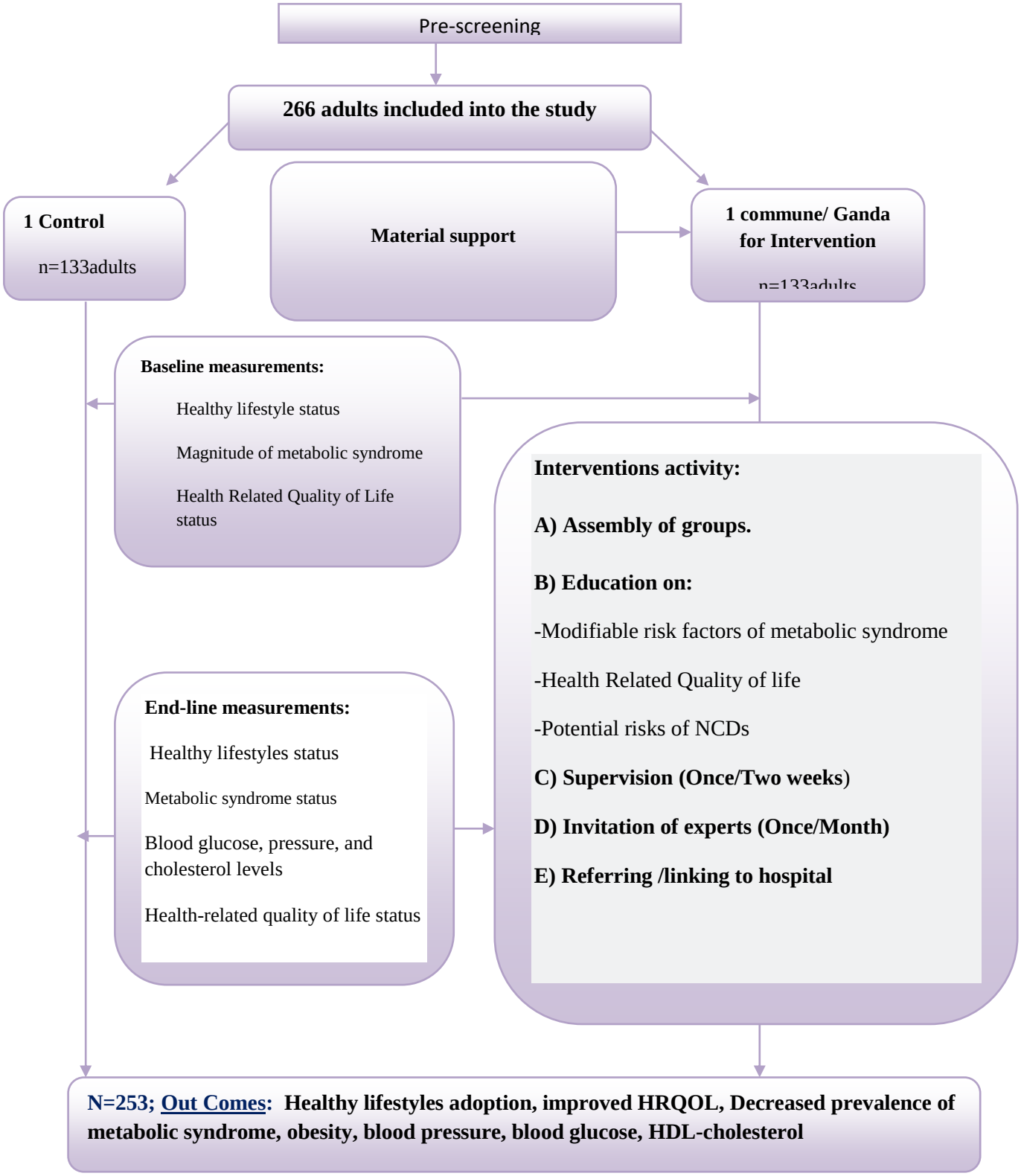


Figure 2:3 *Strategic study for healthy lifestyles education on: Modifiable risk factors of metabolic syndrome and health related quality of life among middle age adults, 2023.*

2.9.1. LEADERSHIP STRATEGIES OF INTERVENTION

The effectiveness of the program was based on the strengthening of the leaders. This work might explore the interplay between leadership, and implementation outcomes of the healthy lifestyle education intervention. To accomplish the tasks, the intervention groups were grouped into manageable teams. For two groups one leader was assigned, a total of four group leaders and one general leader led the overall activities during the intervention period and the researchers organized the intervention. At each of the end days of the week, the general leader collects the activities phones among the team from four leaders and records the event, and the research teams collect the information through observations (Fig. 2:4).

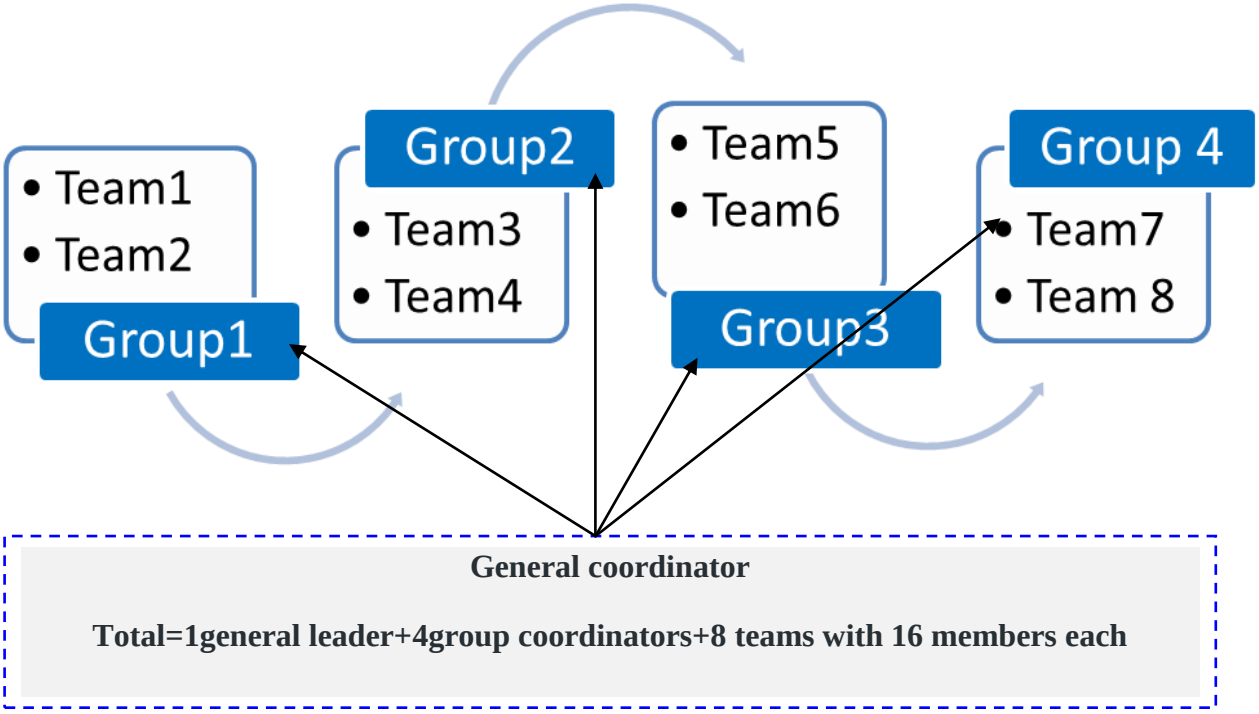


Figure 2:4 *A schematic representation of how the community-leader leads and controls intensively the group leaders and each teams during the lifestyle educational intervention in Nekemte (n=133), 2019.*

2.9.2. INTERVENTION MONITORING AND EVALUATION

Obedience to the intervention was enhanced and recorded by monitoring activities and process evaluation. Monitoring of intervention implementation was conducted by supervisory visits to communities and performance evaluation meetings with the general leader, team leaders, group leaders, and investigators. Once in two weeks of duration, the group leaders asked through the telephone for the attendance of adults to reduce dropout. Periodic field visits were made by the research team. The research team also had periodic meetings to assess the progress of the project, telephone calls, and discuss necessary adjustments. The purpose of process evaluation is to document the intervention implementation process to assess whether the intervention activities are implemented as planned; evaluate the extent to which the intervention reached middle-aged adults; determine the degree to which target groups are exposed to intervention components; examine contextual factors that may have an influence on intervention effectiveness and provide information that can assist in the interpretation of the outcome indicators.

2.9.3. INTERVENTION PROTOCOL

In recent years there has been much interest in theories of behaviour and models of behaviour change largely drawn from psychology and informed by economics and sociology (Michie S, *et al*., 2008). They consider the wide range of psychological, social, societal and contextual factors such as emotions, habits and routines (Darnton A., 2008).The theories of change support interventions by describing how behaviours develop and change over time. Behavioural models are designed to help us understand behaviour and identify the underlying factors that influence it. An understanding of both aspects is needed to develop effective intervention strategies (Michie S & Johnston M, 2012, Darnton A., 2008). At the end of the meetings, each participant was given a leaflet and educational training manuals.

Table 2:1. The planned sessions, titles, behavioral change model on health promotion construct, content, methods, and purposes of the community-based healthy lifestyle educational Intervention, 2019.

HPM	Session & title	Intervention: content, purpose & methods	whom	Indicator
Perceived susceptibility	Session 1: Introduction to healthy lifestyle education	-Brainstorming and discussion with participants to reach agreements before actual intervention for 50-90minutes.	Research Teams and Community leaders	Signed consent
		-Introduction to the program, understand the signs, symptoms, complications and management of lifestyle diseases, emphasis on benefits of lifestyle modification: diet, physical activity, smoking and alcohol cessation.		Attendance and frequency
Perceived susceptibility	Session2: Introduction to Metabolic Syndrome and health-related quality of life	-Introducing the researcher and colleagues and expressing the educational goals; starting the training about the defnition of MetS, causes and symptoms and risk factors, diagnosis, complications and its effect on HRQoL.	Research Teams Community leaders	Participants attended interventions
		-Leaflet with keymessage (in English & Afan Oromo) for intervention groups once.		
Perceived benefits.	Session 3: Healthy listsyle adoption	-To improve knowledge about healthy eating, principles of healthy diet (tips to reduce salt, sugar, and fatty intake)	Research Teams Community leaders	Participants attended interventions
		-To know the appropriate types of exercise, physical activity for middle aged adults and weight reduction purposes. Diseases related to unhealthy diet and physical inactivity.		
		-Health benefits of achieving the targeted goals of healthy lifestyle.		

Perceived barriers	Session 4: healthy lifesty barriers; following WHO recommendations.	-Identify obstacles; learn about problem solving and decision making. Common barriers to exercise and coping strategies. -To know what junk foods are rich in salt, sugar, and fats? Tips to improve the quality of food choices and shopping tips i.e. reading food labels and nutritional facts, preparation of the shopping lists and planning ahead. -Measuring your own weight, maintain body weight, BMI, waist circumference, BP and blood sugar.	Research Teams Community leaders	Participants attended interventions
Self-efficacy	Session 5: Following a proper healthy lifestyle	-Adopting healthy lifestyle, how to achieve 150 minutes per-week & moderate intensity exercise. Reminding Community leaders who modiriate the interventions.	Research Teams Comty leaders	Frequency
Self-efficacy	Session 6: Motivational talk and sharing of experience	-Sharing of personal experiences by two role models (i.e., a retired civil servant and a hypertension patient). Encourage other participants to share their own experiences and motivations about staying healthy.	Research Teams Community leaders	Frequency
Self-efficacy	Session 7: Looking back and looking forward.	-Looking backward is to flash back on all the activities that have been conducted. -Looking forward is how to keep motivated and sustained healthy lifestyle.	Research Teams	

		-All participants signed up a "My personal Lifestyle Contract" and token of appreciation to all participants. -Selection of participants who achieved the healthiest lifestyle, full attendance in all activities and managed to return to the normal blood glucose level.	Community leaders	Frequency
		-Summarizing all the training materials and reviewing them and answering participants' questions. Post test for training and closing the session	Research Teams Comm.leaders	Success of intervention
NB: Each session of healthy lifestyle educational intervention had a session plan.				

2.9.4. INTERVENTION FIDELITY

The fidelity of the intervention was evaluated using best practice recommendations developed by the National Institutes of Health (NIH) Behavioural Change Consortium(Bellg *et al*., 2004). The recommendations cover study design: establishing procedures to monitor and reduce the potential for information contamination between active intervention and control; provider training: standardization of training to ensure that all providers are trained in the same manner; healthy lifestyle education delivery: behavioral checklists to ensure that providers adhered to the intervention protocol and treatment receipt: through supervisory visits to the study area and performance evaluation meetings with the lifestyle educators, community leaders, and community health workers. Monthly meetings were conducted to discuss issues regarding the consultations, and measurements to ensure their compliance to the intervention protocol. Attendance sheets were reviewed and discussed. In addition to calling weekly to general manager, the team leaders and participants were randomly checked for physical activity consultation notices by the team of the researchers.

2.10. DATA COLLECTIONS

2.10.1. TYPES OF DATA

Primary data was collected through direct interaction with the respondents, while secondary data was collected from past research studies, published sources, Online databases, publicly available data, or government and institutional records.

2.10.2. DATA COLLECTION TOOLS

The tool was first written in English, translated into the native language (Afan Oromo), and then translated back to English to ensure consistency. Five BSc nurses, two MPH/MSc in Nutrition, and three medical laboratory Technicians collected the data, supervised by four masters of Public Health professionals and the principal investigator. The data collectors and supervisors received five days of training on the data collection tools and procedures. The following tools were applied to collect data: Structured questionnaires, Biophysical measures, Biomarkers, Checklists, observations, Focus Groups, and Questionnaires based on the constructs of the theory of planned behavior.

2.10.3. DATA COLLECTION METHODS

This dissertation used common data collection methods including surveys, interviews, observations, focus groups, experiments, and secondary data analysis. Data were collected by using the World Health Organization's Stepwise approach to non-communicable disease surveillance (WHO, 2005). First, necessary information was collected by a structured questionnaire. In phase two anthropometric measurements were taken by using the SECA weight measuring scale, measuring tape at the midpoint of the inferior margin of the last rib and the iliac crest at the end of expiration (WHO, 2008), and Blood pressure was measured by sphygmomanometer from the right and left arms after participants rested for 5 minutes. In the third phase of the biochemical analysis, 5 milliliters of fasting venous blood was taken from each study participant. Qualitative data were gathered using qualitative methodology encompassing focus group discussions and semi-structured interviews with middle-aged adults.

2.10.4. DATA RELIABILITY AND VALIDITY

Reliability refers to the consistency of a measure (whether the results can be reproduced under the same conditions). Validity refers to the accuracy of a measure (whether the results represent what they are supposed to measure). The respondents were requested for their time before the

main study or beta test. According to Mugenda and Mugenda (2003), the reliability pre-test sample size can be between 1% and 10 % of the total sample. Thus, 5 % of the total sample was used as a pilot study to ensure reliability. A pilot test was carried out to evaluate the completeness, precision, accuracy, and clarity of the questionnaires. This ensured the reliability of the data collection instruments used. After the amendment of the final questionnaire, the researcher explained the purpose of the research and sought permission from the institution to carry out the actual research. The final questionnaires were distributed to the respondents with the help of research assistants. This enhanced the speed of data collection. Each completed questionnaire was treated as a unique case and a sequential number was given to each. Filling out the questionnaire took approximately 10 minutes. The collected data was edited and entered into the Statistical Package for the Social Sciences (SPSS version 24) software to enable the carrying out of the analysis.

2.11. DATA ANALYSIS

Data were analyzed using a statistical package for the social sciences software package (Version 24, Chicago, IL, USA), and results were presented in a table, and chart forms. The data were collected at baseline & end line then checked, entered into a pre-drafted coding sheet on Epi-info software (version 3.5.3) by two different data clerks, and transferred to SPSS. Outliers and missing values were checked before performing any analyses. Besides the normality and abnormality distribution of data: descriptive statistics and inferential statistical tests were used. All linear variables with normal distribution are expressed as mean±SD scores. All variables showed association bivariate logistic regression was geared to appropriate regression model analysis. The significance level was considered at alpha as less than 0.05.

Bivariable and multivariable analyses were used to assess the relationship between independent variables and dependent at 95% CI. The effectiveness of the education was evaluated by comparing interventions that have taken education and comparison groups for the outcome measures. The Pearson correlation analysis was used to investigate the relationship between the variables, and the TPB constructs. Statistical significance was declared at a p-value of less than 0.05.

2.12. MODEL DIAGNOSTIC TESTS AND ASSUMPTIONS

Before running the regression model, the existence of homoscedasticity, multi-collinearity, and normality assumptions was checked. Multivariable logistic and linear regression models were used to isolate independent predictors of metabolic syndrome and its components, respectively. For the multivariable linear regression, all nine assumptions including linearity, normality, independence, homoscedasticity, and multicollinearity were checked using Q-Q plots, and multicollinearity was checked using the variance inflation factor. Most studies argue that if the mean VIF is less than 10, the model has no problem with multicollinearity (Gujarati, 2004). Robust regression was employed to test the assumption of homoscedasticity. For the multivariable logistic regression, multicollinearity was checked using standard error $P<0.2$ and the Hosmer Lemeshaw test ($P>0.05$) was used to check model fitness. Statistical significance is set at p-values < 0.05. A linear mixed-effects model was used to estimate the effect of the intervention on changes in the metabolic syndrome status of middle-adulthoods over time. Before fitting the model, the normality assumption of the outcome variables (BMI, WC) was assessed by using the Shapiro−Wilk's test and the test showed that the assumption was satisfied ($p > 0.05$). We used the Akaike information criterion (AIC) to assist in selecting the appropriate statistical model. We chose the model that demonstrated the minimum AIC. Variables with $p < 0.2$ in the bivariate linear mixed regression model were selected as candidate variables for the multivariable linear mixed model analysis. The intervention's effectiveness was assessed by examining the interaction between time and the intervention.

2.13. OPERATIONAL DEFINITIONS AND MEASUREMENTS

Metabolic Syndrome (MetS) was defined based on revised NCEP ATP III criteria, as the combination of three or more of the following: (Kim, J, *et al*, 2019, IDF, 2018, WHO,2016) abdominal obesity (waist circumference ≥ 90 cm in men or ≥80 cm in women); (Lim, M. and Kim, J.2020) elevated BP (≥130/85 mmHg, physician's diagnosis of hypertension or medication for elevated BP); (Aguilar, M. *et al*, 2015) hypertriglyceridemia (serum TG concentration ≥ 150 mg/dL, medication for elevated TG); (Koh, K.K. *et al*, 2021) (elevated fasting glucose (fasting blood glucose ≥ 100 mg/dL, physician's diagnosis of type 2 diabetes, medication for elevated glucose or use of insulin); and (Al-Qawasmeh, R.H and Tayyem, R.F, 2018) reduced HDL-C

(serum HDL-C concentration < 40 mg/dL in men or <50 mg/dL in women, medication for reduced HDL-C).

Dietary intake was assessed using food frequency questionnaires, and each individual's dietary diversity score (DDS) was calculated. Twelve food groups were constructed from a classification of food group items based on the existing literature (Loef M, and Walach H.2012) and the United Nations Food and Agriculture Organization's Household Dietary Diversity Score (HDDS) 2017 guidance. The DDS was calculated by counting the number of food groups covered by dietary intake over a reference period of one week. For instance, an adult who consumed one item from every food group at least once during the week would have the maximum DDS. The DDS was converted into tertiles and the highest tertile was defined as a "high" dietary diversity, the next highest tertile was defined as a "medium" diversity, and the lower two tertiles combined to define a "low" dietary diversity. Similarly, the household score was defined as the total number of food groups consumed by the household, ranging from 0 to 12.

Data on socio-economic status were gathered using the items used for wealth status measurement in the Ethiopian Demographic and Health Survey. The FANTA(FANTA, 2013, FAO,2013) a seven-day food-frequency questionnaire was used to assess HH dietary diversity score with 12 food groups. Anthropometric assessment was carried out using standardized techniques. Weight and height measurements were taken using calibrated equipment (Taylor Lithium Electronic Scale for weight and a portable studio meter) and waist circumference by tape meter.

The HDDS indicator provides a glimpse of a household's ability to access food as well as its socioeconomic status(Kennedy *et al*. 2011). Guiding Framework, Retrieved October 21, 2017, Method of Construction, the following 12 food groups are used to calculate the HDDS indicator: A. Cereals B. Root and tubers C. Vegetables D. Fruits E. Meat, poultry, offal F. Eggs G. Fish and seafood H. Pulses/legumes/nuts I. Milk and milk products J. Oil/fats K. Sugar/honey L. Miscellaneous; Each food group is assigned a score of 1 (if consumed) or 0 (if not consumed). The household score will range from 0-12 and is equal to the total number of food groups consumed by the household: Sum (A + B + C + D + E + F + G + H + I + J + K + L). The average household dietary diversity score for the population of study can be calculated as follows: Sum (HDDS)/Total number of households surveyed.

Height was measured with an adjustable portable stadiometer which was accurate to 0.1 cm. Waist circumference was measured with a fixed tension tape, at the midpoint between the lower costal margin at the mid-clavicular line and the anterior superior iliac crest in a private place with no clothing on the upper part of the body (WHO, 2008).

Blood pressure, Lipid Profiles, and Fasting Blood Glucose: Blood pressure was measured after individuals had rested for 5 minutes. Three blood pressure measurements were taken in a difference of five minutes between successive measurements. By the WHO recommendation, the mean systolic and diastolic BP measurements were considered for analysis. A five-mile letter blood sample was collected for each individual in the morning after overnight fasting using proper sanitation and infection prevention techniques. Serum was used for the measurement of triglycerides (TG), total cholesterol (TC), high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), and glucose concentrations. For the end line data, a five ml blood specimen was collected with a senior medical laboratory technologist, the serum was separated from the whole blood within 30 minutes and the serum was transferred to Nunc tubes and stored in -20^{0c} refrigerators. After all the specimens were collected the serum was packed with ice and transported to Wollega University specialized Hospital and the lipid profile tests were done at this hospital laboratory with HumaStar 80 (Germany) using standard operating procedures. Fasting blood sugar was determined using Humastar within two hours of collection in the Cheleleki Health center.

Raised fasting blood sugar is defined when hemoglobin level exceeds 100mg/dl; (FBS≥126mg/dl) as diabetes and FBS>100 to ≤125mg/dl were pre-diabetes (IDF. 2015 and 2018). Participants were interviewed with questionnaires to report their behavior with regards to four major lifestyle factors: smoking tobacco (current smoker, former smoker, never smoked), alcohol (current drinker, former drinker, never drank), khat chewing (current chewer, former chewer, never chewed), and physical activity level (low 55–64%, moderate 65–74%, vigorous 75–90% of maximum heart rate).

Health-related quality of life (HRQoL): is the perceived effect of health status on quality of life (QoL) which includes EQ_5D. EuroQol 5-dimensions measure HRQoL using validated five domains: mobility; self-care; discomfort/pain, depression/anxiety, and usual activities (Katherine, *et al*.2006, Janssen, M. F., *et al*.2013, WHO.2018). Each item is answered using one

of three responses: no problem, some problems, and extreme problems. It is a golden standard (Van Reenen M, Oppe M. 2015) and recommended by NICE for use in cost-effectiveness analysis (Brazier, *et al.*1999). Health-related quality of life was assessed using EQ_5D tools. HRQoL was assessed using the EQ-5D, according to WHO guidance. Participants with a "poor" score in one or more of the five domains of EQ-5D were considered as having poor HRQoL.

Anxiety is an adaptive and universal human reaction to stressful situations. The most common measure used to assess anxiety in treatment outcome studies is the Hamilton Anxiety Scale (HAM-A) which is a primary measure for generalized anxiety disorder (GAD) and is often used to assess general anxiety symptoms across conditions (Philipp M, *et al,* 1988).

Community leadership: refers to the fact that communities should be placed at the center of responses and exercise this type of leadership.

Lifestyle of Learning: is an educational model that incorporates learning into all aspects of life and life into all aspects of learning. It's living books, life lessons, doing and being, active and living.

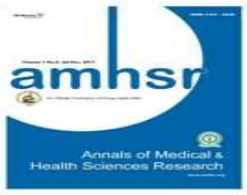
The Health Promotion Model aims to explain the factors underlying motivation to engage in health-promoting behaviors and it focuses on people's interactions with their physical and interpersonal environments during attempts to improve health. **Self-efficacy**: is an individual's belief in his/her effectiveness in performing specific tasks as well as in their actual skill(Pender, N.J. 2011).

2.14. ETHICAL CONSIDERATIONS

The research protocol was approved by Jimma University; Institute of Health; Institutional Review Board (IRB; Approval No: IHRPGD/596/2019). All participants were provided with an information sheet, and confidentiality, and signed a written consent form before beginning healthy lifestyle education and were made aware that they are free to withdraw at any time.

CHAPTER 3: METABOLIC SYNDROME AND HEALTH-RELATED QUALITY OF LIFE AMONG MIDDLE-AGED ADULTS OF WESTERN ETHIOPIA.

3.1. METABOLIC SYNDROME AND ITS ASSOCIATION WITH QUALITY OF LIFE AMONG MIDDLE AGED URBAN RESIDENTS IN WEST ETHIOPIA.



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ABSTRACT

Background: Metabolic syndrome is a major health disorder facing all people and obesity become an epidemic worldwide. In developing countries, undiagnosed Mets constitute a challenge for health providers; screening healthier communities for Mets and poor quality of life was not practiced, especially in West Ethiopia.

Objective: To assess the magnitude and association of Mets with HRQoL among undiagnosed middle-aged urban residents of West Ethiopia.

Methods: A community-based cross-sectional study design was applied to 266 unscreened healthy adults from January 01, 2019, to March 01, 2019. By using SPSS version 24, an association between metabolic syndrome and health-related quality of life was identified. Statistically significant variables were considered at $p < 0.05$ on multivariable logistic regression analysis.

Results: The overall prevalence of undiagnosed MetS was 19.92% and the majority (91.7%) of participants had poor healthy lifestyles. The most frequent metabolic syndrome components were central obesity, blood pressure, hyperglycemia, and low-density lipoprotein accounting for 41.20% as of ATP-III or 58.60% as of Ethiopian cutoff references, 18.4%, 24.4%, 20.4%, and 19.5%, respectively. Findings of multivariable logistic regression analyses showed that mobility

problems were significantly associated with metabolic syndrome (AOR: 7.53; 95% CI: 2.00–12.70; p, 0.003). Similarly, having higher odds of metabolic syndrome was noted as likely in depressed respondents after adjustment (AOR: 1.46; 95% CI, 1.13-1.65, p=0.233), however not significant. Likewise, HRQoL confirms a significant association with metabolic syndrome (P=0.009).

Conclusions: This study reveals undiagnosed MetS, and poor HRQoL were prevalent and shows there was association between them among urban residents of West Ethiopia. Therefore, educating the community on healthy lifestyles, and creating awareness of metabolic syndrome were significant to improving quality of life and mitigating non-communicable diseases.

Keywords*: Metabolic syndrome, healthy lifestyles, quality of life, middle-aged, West Ethiopia*

1. INTRODUCTION

The global prevalence of NCDs is increasing rapidly, including in low and middle-income countries, and 2012 almost 75% of NCD-related deaths where took place (Sommer I, *et al*.2015). In developing countries, over-nutrition is the second 'silent emergency' due to rapid urbanization and shifting of diet (B. Popkin, 2011) and 79% of deaths attributable to chronic diseases occur mostly during middle-aged (WHO, 2002).

In 2000WHO reported that about 800,000 cases were recorded in Ethiopia, and this number is projected to rise to 1.8 million by 2030. Also WHO reported in 2013 showed about 1.9 million diabetic patients were seen in Ethiopia (Abdulkadir J and Ahmed R. 2001, Mistire Wolde Gebre, 2013). Findings from Tikur Anbessa Specialized Hospital also reveal that 9.9% of undiagnosed employees in that hospital were at high risk for developing T2DM and about 13.9% of the females had gestational diabetic mellitus (Wakjira ZN and Berha AB.2017).

The risks of NCDs are increasing because of unhealthy lifestyles, such as tobacco, unhealthy diet, risky alcohol drinking, and physical inactivity (Yan Zhang *et al*. 2016). Metabolic syndrome is the result of interconnected physiological, biochemical, clinical, and metabolic factors. It is also defined as having abdominal obesity plus any two or more of the following risk factors: elevated blood pressure, reduced high-density lipoprotein cholesterol (HDL-C), elevated triglyceride levels, and raised fasting plasma glucose (Daniels SR, *et al.2005,* WHO 2015, Kaur J. 2014).

Unhealthy lifestyles are the most common modifiable risk factors of metabolic syndrome. The impact of unhealthy lifestyles not only undermines the quality of life and productivity but also contributes to death and economic losses. Morbidity costs represent lost income from reduced productivity, restricted physical activity, absenteeism, and bed days. Mortality costs encompass lost future income due to premature death (Arlene Spark P., 2007). According to the Ethiopian Public Health Institute report in 2016, the cumulative economic losses due to NCD burden in low & middle-income countries between 2011 and 2025 were estimated to be 7 trillion USD. Population norms for HRQoL are an essential ingredient in health economics and in the evaluation of population health (Kularatna S. *et al*, 2014).

Degenerative diseases can be delayed, prevented, or managed through healthy behaviors (Dietz, *et al*. 2017), yet lifestyle-related health risk factors still lack focus. In 2013, the American Medical Association classified obesity as a disease. It is most commonly caused by a combination of an unhealthy diet, physical activities, and genetic susceptibility. Dieting and exercising are medicines for obesity and reducing disability and death from chronic diseases (Medical Diseases Dictionary. 2017, Hawkes C. 2013).

The promotion of healthy diets and physical activity should be a core competence of primary care providers, who play an important role in providing individual services to tackle the burden of NCDs (WHO, 2016j). The nutrition transition is exacerbated by decreased physical activity, a stressful lifestyle, risky alcohol drinking, and tobacco use (Nelia P.Steyn and Zandile J. Mchiza 2014, Wedick, et al. 2012).

Improving the quality of life reduces health inequalities as it systematically measures the relationship between health and health-related quality of life. It is important to note that certain domains and the factors related to those domains might be especially influential for subjects' HRQoL (Pokhrel S, *et al*. 2012, Saffari M, *et al*.2015, Van Reenen M, Oppe M.2015).

A study conducted in Addis Ababa revealed that the prevalence of metabolic syndrome was 14.0% in men and 24.0% in women (Girum Tefera, 2015). Similarly; according to IDF definition in the study population the overall prevalence rate of Metabolic Syndrome (Met S-IDF) in Jimma Town was estimated to be (16.7%) (Rajesh. P.N, *et al*.2016).

Even though metabolic syndrome is prevalent in urban areas, particularly in workforces and women, in Ethiopia the effect is not yet registered nationwide. Also, Ethiopia had no optimal cut-

off points for defining a metabolic syndrome and risk components of adults, rather than using cot-off points from the Caucasian population (Sinaga, *et al*.2018). Screening for metabolic disorders among healthy individuals is ignored as the literature showed (Reynolds K, *et al*. 2008); evidence also suggests that an abnormal metabolic profile, rather than a high BMI, is associated with a higher risk of diabetes and cardiovascular diseases (Fox CS, *et al*. 2006).

In line with the concept, because of chronic degenerative diseases, most young age adults are dying due to biological age rather than chronological aging. Unless risk factors of metabolic syndrome are prevented earlier, the consequences range from serious chronic conditions like stroke, type II diabetes, hypertension, selected types of cancer, and distortions of quality of life to premature death. Therefore, this study aimed to assess the prevalence and association of metabolic syndrome with quality of life among unscreened middle-aged urban residents in West Ethiopia.

2. METHODS

2.1. STUDY DESIGN AND SETTING

A community-based cross-sectional study design was adopted following the approaches of WHO to conduct the research on middle-aged urban residents in West Ethiopia. Because of the hub center for western towns (Assosa, Ambo, Bure-Bahirdar, Metu, and Jimma), we selected Nekemte. It is 328 km far from Addis Ababa (Finfinne) and has six kebeles. Its city projection in 2017 is estimated to be 117,819 and out of this adults 51 %(117,819= 60,088) (CSA, 2007). This Town has one specialized Hospital, one referral Hospital, and three Health centers. Community-based education on healthy lifestyle adoption, prevention of risk factors of metabolic syndrome, and improvement of quality of life was given from January 1 to March 2019, so these results serve as a baseline.

2.2. SOURCE AND STUDY POPULATION

All middle-aged adults [41-64 years] living in Nekemte Town during the study time were the source of the population. All middle-aged (41-64 years) adults in the selected communes who registered as residents and had lived in the community for more than six months were included in the study population.

2.3. INCLUSION AND EXCLUSION CRITERIA

Participants who lived at least six months and were aged 40 to 65 years were eligible to participate in the study However, those on medication and have known cardiovascular disease; attended behavioral change communication program; pregnant & lactating; bariatric surgery; us anti-psychotics and physical disables were excluded.

2.4. SAMPLE AND SAMPLING TECHNIQUES

Two hundred sixty-six participants were calculated using a single finite population proportion formula by using Epi Info™ 7 by considering the following assumptions: a margin of error of 3%, 80% power, 10% non-response rate, and central obesity (19.6%) the most common prevalent metabolic syndrome component Ethiopian adults (GirmaB, et al. 2011).

From six kebeles (small administrative unit), two kebeles which were not adjacent but homogeneous in terms of socioeconomic and geographic variables were selected. Since data were used as a baseline for an intervention, one kebele was randomly selected and the other was purposively allocated with a buffering zone through natural geography to avoid data contamination (Chapter 2).

2.5. DATA COLLECTION

Data were collected using structured questionnaires through interviews of adults in the local language that were translated from English version by trained research assistants to return to the original concept. Self-administered questionnaires and anthropometric and biochemical measurements were used to collect data. Anthropometric assessment of adults carried out using standardized techniques. Weight and height measurements will be taken using calibrated equipment (Taylor Lithium Electronic Scale for weight and a portable stadiometer/sac-Germany) with light clothes and no shoes.

For laboratory analysis, 5ml of venous blood samples from the ante-capital vein were taken after. The study participants were advised to take an overnight fasting of 10-12 hours before collecting the blood samples for the determination of FBG and lipid profiles. Fasting blood (plasma) glucose, serum total cholesterol, HDL-C, and triglycerides were determined by the Auto analyzer (Human Star Model 80) method by using specific reagents (Human). LDL-C was calculated

using the Freidwald formula. VLDL = Triglycerides ÷5; LDL = Total cholesterol (HDL + VLDL) (Freidwald et al. 1972).

The anthropometric assessment was done according to the standardized procedures stipulated by the Food and Nutrition Technical Assistance (FANTA) Anthropometric Indicators Measurement Guide by Seca Germany (Cogill B. 2003).

2.6. OPERATIONAL DEFINITIONS

Metabolic syndrome was defined as the presence of central obesity defined by (a waist circumference of 83.7 cm for males and 78.0 cm for females, BMI> 22.2in men, and 24.5kg/cm2 in women since Ethiopian have10% less slim (Sinaga, *et al*. 2018) which is equivalent to (BMI≥25kg/m2) (WHO, 2016j); Plus any two of the following factors: raised Triglycerides level: ≥ 150 mg/dl (1.7 m mol/L), reduced HDL-cholesterol: <40 mg/dl (1.03 m mol/L) in males and <50 mg/dl(1.29 mmol/L) in females, raised Blood Pressure: systolic BP≥ 130 or diastolic BP≥ 85 mm Hg, and raised Fasting Plasma Glucose (FPG) ≥100 mg/dl (5.6 m mol/L).

Diet diversity was constructed according to FAO (2013), by counting the intake of the food groups over one week based on the sum of food groups consumed over the reference period. For instance, an adult who consumed one item from each of the food groups at least once during the week would have the maximum DDS.

Based on WHO guidelines health-related quality of life is defined as poor if the participants had one and/or more number of poor /complaints from the five domains of EQ-5D(CDC,2012).

2.7. DATA ANALYSIS

Data analyses were done using SPSS for Windows version 24(Chicago, Illinois) after checking for missing values and outliers. Descriptive analysis was carried out using risk score as the dependent variable, with age, gender, smoking, physical activity, BMI, WC, ethnicity, educational status, religion, income, fruits and vegetables eating habits, previously measured history of blood glucose & pressure, presence of metabolic syndrome.

Regression analysis was used to identify the factors associated with metabolic syndrome and health-related quality of life. Bivariate logistic regression was used to determine the association

between lifestyles with modifiable risk factors of metabolic syndrome & health-related quality of life. Variables with a P-value ≤0.25 in bivariate analysis were selected as candidate variables multivariable logistic regression model to identify the association of independent factors. The odds ratio together with their corresponding 95% CI was computed. Multi-co linearity among independent variables was assessed using the standard errors. The standard errors for regression coefficients <2.0, as a familiar cutoff value, showed that there was no multicollinearity among independent variables. Normality was checked for continuous variables. A P-value <0.05 was considered as statistically significant.

2.8. ETHICAL APPROVAL

This study was approved by the Institutional Review Board of Jimma University (Approval No. IHRPGD/596/2019; January 1, 2019). Support letter was also taken from Nekemte Health Bureau (1173/WEFMN/2011) and all concerned bodies. Before the first interview, participants were informed about the objectives of the study and privacy during the interview. Written consent was also obtained from individual participants.

2.9. PLAN FOR DISSEMINATION OF FINDINGS

There are three main methods of dissemination, namely the three Ps: posters, presentations, and papers/articles. Also, conference presentations, performances, exhibitions, reports, media interviews, social media, and participation in debates are some of the ways how the dissertation was disseminated.

3. RESULTS

3.1. SOCIO-DEMOGRAPHY OF PARTICIPANTS

From two hundred sixty-six undiagnosed populations, 62.8% were females. On average the age of study participants was 52.5 years and the largest population (89.5%) was Oromo followed by Amhara (6%). Likewise, 41.4% of the respondents were live in low-income classes. Similarly, almost all (92.5%) of respondents did not have urban farming/home gardening and 54.9% of them lived below the poverty threshold (Table 3:1.1).

Table3:1.1 Socio-demographic characteristics of participants, urban, west Ethioipa,2019.

Variables	Categories	Frequency (n)	Percent (%)
Gender	Female	167	62.8
	Male	99	37.2
Age in years	41-48	145	54.5
	49-56	77	28.9
	57-64	44	16.5
Educational status	Illiterate	86	32.3
	some school	119	44.7
	Diploma/certificate	33	12.4
	Degree and above	28	10.5
Marital status	Single	13	4.9
	Married	178	66.9
	Widowed	56	21.1
	Divorced	19	7.1
Religious	Protestant	160	63.9
	Orthodox	88	33.1
	Muslim	6	2.3
	Wakefata	11	0.4
	Others	1	0.4
Ethnicity	Oromo	238	89.5
	Amhara	16	6.0
	Tigre	6	2.3
	Others	6	2.3
Occupation status	Job less	135	50.8
	light work	30	11.3
	long hour sitting work	61	22.9
	Long stand work >4hrs	40	15.0
Estimated average monthly income	< 37.5 USD	146	54.9
	37.5-75 USD	74	27.8
	75-100USD	9	3.4
	> 100 USD	37	13.9
Urban farming	Yes	20	7.5
	No	246	92.5
Health insurance	Yes	7	2.6
	No	259	97.4
Wealth quintiles	Lowest/the poorest	110	41.4
	Second quintiles	80	30.1
	Middle quintiles	68	25.6
	Fourth quintiles/richest	8	3.0

3.2. COMMON MODIFIABLE RISK FACTORS

Out of the 266 participants, small number of participants (2.3%) were currently smoking cigarette. Similarly, 9.8% of participants were currently drink risk alcohol and 1.1% chew khat. Almost (98.9%) respondents consuming saturated oil and only 24.8%of them were consuming vegetables at least five services or slices per day. More than two third (68%) respondents had low dietary diversity score. The overall mean ± SD of DDS was 5.4 ± 1.9. Large proportion of participants (91.0%) was engaged in low physical activity. Similarly, more than half (58.6 %) of the participants were found to have central obesity (high waist circumference) (Table 3:1.2).

Table3.1.2 Distributions of lifestyle behaviors of middle aged, urban, west Ethiopia, 2019

Variables	Categories	Frequency	Percentage (%)
Smoking	Current smoker	6	2.3
	Former, but quit now	21	7.9
	Never smoker	239	89.8
Alcohol	Current drunker	26	9.8
	Former ,but quit now	40	15
	Never	200	75.2
Khat	Current chewer	3	1.1
	Former ,but quit now	18	6.8
	Never	245	92.1
Physical activity	Physical inactive (Low PA)	242	91.0
	Moderate(3ds&120-150 m'/wk)	13	4.9
	Vigorous (≥3days/150m'/wk)	11	4.1
Sleep	Yes I have apnea	92	34.6
	Sometimes fragmented	108	40.6
	Normal	66	24.8
Salt	Yes, use > 1teaspoon/>6g/day	266	100
	As of standard/<6g/day	0	0
Sugar	Use excess dose	261	98.1
	As of standard	5	1.9
Daily Fruit	> five services/400 g/day/capita	6	2.3
	No, but occasionally	260	97.7
Daily Vegetable	At least five services/400g/day	66	24.8
	No, but occasionally	200	75.2
Saturated oil	Saturated oil always	263	98.9
	Clotted oil & animal butter	3	1.1
dietary diversity score	Low dietary diversity	181	68.0
	Medium dietary diversity	76	28.6
	High dietary diversity	9	3.4

3.3. LIPID PROFILES AND ANTHROPOMETRIC MEASUREMENTS

Out of the 266 participants, 27.8%, 16.2%, 7.14% ,18.4% and 20.3% were had undiagnosed raised SBP, DBP, FBS ,BP and raised triglycerides respectively. More than half (58.6 %) of participants were found to have central obesity and 19.92% of participants had metabolic syndrome (Table 3:1.3).

Table 3:1.3 Mean & frequency distribution of lipid profiles & anthropometric of adults, 2019

Variables	Mean ±SD	Categorical	Frequency	Percent %
BMI	22.85(3.68)	Normal	131	49.2
		Overweight	52	19.5
		Obese	65	24.4
		Chronic energy deficiy	18	6.8
Central obesity	85.39(8.37)	Yes	156	58.6
		No	110	41.4
High Hip circumference	93.49(9.05)	Yes	192	72.2
		No	74	27.8
Raised Systolic BP≥130	120.02(14.24)	Yes	74	27.8
		No	192	72.2
Raised Diastolic BP≥85	77.11(8.98)	Yes	43	16.2
		No	223	83.8
Raised BP ≥130/85 mmHg	---	Yes	49	18.4
		No	217	81.6
Raised FBS≥100mg/dl	99.70(29.60)	Yes	19	7.1
		No	247	92.9
Raised TG level≥150mg/dl	131.63 (24.92)	Yes	54	20.3
		No	212	79.7
Reduced HDL <40 for M <50 for F	52.01(10.34)	Yes	52	19.5
		No	214	80.5
Had Metabolic syndrome	--------	Yes	53	19.92
		No	213	80.08

3.4. FACTORS ASSOCIATED TO METABOLIC SYNDROME

Findings showed that the outcome variables were associated with metabolic syndrome. On multivariate logistic regression analysis BMI, high blood pressure, and HDL-cholesterol showed

an association with metabolic syndrome. The developing metabolic risk was about nine times higher in those with a systolic blood pressure of ≥130mmHg (AOR: 9.30; 95% CI 1.12–77.37; P, 0.039). Similarly, FBS≥ 100 mg/dl was found to increase metabolic syndrome risk by more than fourfold (AOR: 4.42; 95% CI 1.91, 10.25; P<0.001*). Finally, high BMI was associated more likely than twenty-five and twelve times developing (AOR: 5.67; 95% CI[3.42, 9.09; p<0.0001]) metabolic than other categories(Table 3:1.4).

Table 3:1. 4 Multivariate analysis of outcome variables associated to metabolic syndrome ,urban residents, West Ethiopia, 2019

Variables	Categories	Metabolic syndrome					
		Yes	No	COR(95%CI)	p	AOR(95%CI)	p
High BMI	Normal	3	128	0.40(0.24,0.67)	0.018	2.01(3.61,11.23)	0.001
	Overweight/Obese	38	79	8.18(5.53,13.72)	0.0001	5.67(3.42,9.09)	0.0001
	Chronic enegy def	1	17	1		1	
High SBP (yes>/no<)	>130mmHg	22	49	4.16 (2.12,6.48)	0.0001	9.30(1.12,77.37)	0.039
	<130mmHg	19	176	1		1	
High DBP (yes>/no<)	>85mmHg	13	29	3.14(1.19,4.33)	0.003	1.54(1.19,12.73)	0.688
	<85mmHg	28	196	1		1	
High FBS (mg/dl)	≥100	14	5	22.81(10.02,32.83)	0.0001	4.42(1.91,10.25)	0.001
	<100	27	220	1		1	
Raised Triglycerides	≥150 mg/dl	37	17	113.18(36.05,355.29)	0.0001	4. 14(1.03,5.17)	0.001
	<150 mg/dl	4	208	1		1	
HDL-cholesterol	Yes(F<50&M<40)	22	12	22.30(9.98,49.82)	0.0001	0.05(0.01,0.13)	0.001
	No	29	203	1		1	

Abbreviations: COR-crude odd ratio, AOR-adjusted odd ratio, BMI-body mass index, SBP-systolic blood pressure, DBP-diastolic blood pressure, FBS-fasting blood sugar, HDL-high density lipoprotein. Notes: p<0.05 significant association, (≥25kg/m2=Overweight/obese; (18.5 to 24.9kg/m2 =Normal, <18.5Kg/m2=Chronic def.)

Findings showed that on bivariate analysis from the EQ-5D index, only mobility problems and anxiety/depression were significantly associated with metabolic syndrome. The association was found between EuroQol-5 dimensions and metabolic syndrome. In summative assessment, this study demonstrated that HRQoL showed a significant positive association with metabolic syndrome. Among adults who had poor health-related quality of life the risk of metabolic syndrome was increased. On multivariate logistic analysis, mobility problems and depression were significantly associated. Having mobility problems (AOR =7.53; 95% CI: 2.00–12.70) was

significantly and positively associated with the condition of being a metabolic syndrome. Similarly, the metabolic risk was increased among the depressed population, having metabolic syndrome likely in depressed symptom respondents after adjustment (AOR =1.46; 95% CI, 1.13-1.65), though statistically not significant (p=0.233). Being having poor HRQoL (AOR: 3.15, [95%CL (1.81, 4.96); p<0.009]) was significantly associated more likely three times developing metabolic syndrome than healthier once (Table 3:1.5).

Table 3:1. 5 Multivariate analysis of HRQoL and its dimensions associated to metabolic syndrome ,urban residents, West Ethiopia, 2019

Variables Categories		Metabolic syndrome					
		Yes	No	COR(95%CI)	p	AOR(95%CI)	p
Poor HRQoL	Yes	26	41	4.91(3.12,8.03)	0.001	3.15(1.81,4.96)	0.009
	No	23	178	1			
Mobility problem	Yes	7	10	4.42(1.58,12.42)	0.005	7.53(2.00,12.70)	0.003
	No	34	215	1		1	
Anxiety/ depression	Yes	5	33	0.81(0.13,0.94)	0.006	1.46(1.13, 1.65)	0.233
	No	36	192	1		1	

Abbreviations: COR-crude odd ratio, AOR-adjusted odd ratio, BMI-body mass index, SBP-systolic blood pressure, DBP-diastolic blood pressure, FBS-fasting blood sugar, HDL-high density lipoprotein. Notes: p<0.05 significant association

4. DISCUSSION

The study reveals unscreened metabolic syndrome and its association among urban residents of West Ethiopia. It demonstrated that high ORs of metabolic syndrome increased with its component factors and by using EQ_5D; both ORs & AOR increased with the presence of mobility problems. A healthy lifestyle increases the odds of being metabolically healthy, defined as the absence of any component of metabolic syndrome.

The magnituted of undiagnosed components of metabolic syndrome like raised triglyceride, hypertension, and raised fasting blood sugar were 20.3, 18.4, and 7.14% respectively. Of the participants who had MetS, 67.69 % of them were females, and of those who had poorer, adults aged 41-48 years account for 50.77%. Other study results demonstrated that the prevalence was significantly higher in the middle-aged, and skyrocketed in middle age (WHO.2015, WHO.2011, Paciorek CJ, *et al*. 2011) and typically declined in the elderly (Thamm M *et al.*,2011).

The prevalence of undiagnosed FBS≥100mg/dl (7.14%) was less comparatively with pooled results of urban areas of Sudan (7.7%) (WHO, EMR 2011), urban Egypt (20%)(WHO, 2015) and red delta river of middle-aged Vietnam (40%) (Nhung BT, *et al*. 2014). Since undiagnosed MetS was not conducted on healthier in different urban areas of Ethiopia we compared it with data from other countries. In a study conducted in north India, the prevalence of MetS was 32.5% which is higher than this finding (Rambha Pathak, *et al.* 2018).

Worldwide, one in four (23%) of adults do not currently meet the global recommendations for physical activity (WHO, 2016) which was less compared to this study (91.0%). This result was highly prevalent. We found physical inactivity was associated with MetS, this confirms the study done in another country (Lakka HM *et al*. 2003).

Waist circumference is a measure of central obesity as per IDF as well as ATP-III criteria and Sinaga *et al,* 2018. Based on the cut-off points, this study reveals that 58.60% of adults have high waist circumference which has nearly similar results to the study conducted on Jimma University workers (58.9%) (Tefera G., 2015, Rajesh. P.N *et al*. 2016). The mean± SD of central obesity (85.39±8.37) of our study result was higher than these cut points but lower than German firefighters (89.9±10.0) and office workers (97.3±11.7) (Markus Strauß *et al*. 2016).

On the EQ-5D index, community health quality status was measured among middle-aged adults, Nekemte, in 2019. Pain/discomfort (15%), anxiety/depression (14.3%), and mobility problems (6.4%) were found. Confirming that study conducted in Tehran, pain/discomfort (39.2%) and anxiety/depression 42.3% were why the people suffered(Mohammad K. *et al*., 2016).

The findings demonstrated from EQ_5D, that participants with difficulty in mobility and anxiety/depression showed high significant association with patients with MetS. In general, undiagnosed MetS and HRQoL showed a significant positive association with statistically significant (P<0.009). Similar to this finding, degenerative: hypertension (Hamagishi T, *et al*. 2016), diabetes (Hajian-Tilaki K, *et al*. 2016), and coronary heart disease (Tofighi S, *et al*. 2012) are associated significantly and also in Iran. This study adds a message for public health to stress the community-based diagnosis of NCD, dose of sodium diet intake, fruit, and vegetable consumption, and other food groups by the community. Approximately, all participants consume greater than a teaspoon (>6g/day) of salt a day, 58.60% of them had central obesity and 18.4% elevated blood pressure. These findings confirm other studies, that elevated blood pressure (Vollmer WM *et al*. 2001, Grobbee DE., *et al*. 2003) and central area obesity (Carvajal CA *et al*.

2014, Ji WJ *et al*. 2014) related to a high-sodium diet. The majority (97.7 and 75.2%) of the respondents consume fruit and vegetables occasionally or not at all, respectively.

The study is subject to recall bias because of the cross-sectional nature and unhealthy lifestyle practices were hidden by respondents due to socially unacceptable behaviors and quality of life were self-reported which might under or overestimate the actual levels of risk factors. Any other bottleneck was insufficient biochemical to take a large study population.

5. CONCLUSIONS

The magnitude of previously undiagnosed MetS and Poor HQoL in urban residents of west Ethiopia was 19.92% and 24.4% respectively. By using EQ_5D: mobility problems pain/discomfort and depression/anxiety showed an association and major health complaints. Therefore, to reduce the magnitude, curb NCD, and improve the quality of life among adults, it is recommended: to apply a holistic lifestyle intervention approach, launching a health and nutrition information system or community-based service delivery system and active screening for early detection of risk factors would bring significant changes. To sum up, establishing healthy lifestyle training, diet therapy, and an NCD prevention center is crucial for awareness creation, capacity building, rehabilitation, and job creation at.

3.2. HEALTH-RELATED QUALITY OF LIFE AND ASSOCIATED LIFESTYLE FACTORS AMONG MIDDL-AGE ADULT URBAN POPULATION IN OROMIA, WESTERN ETHIOPIA.

*Drafted from: Alemu Adeba*1, Dessalegn Tamiru1, Tefera Belachew1.Health-related Quality of life and associated Lifestyle Factors among Urban Population adult in Western Oromia, Ethiopia (under consideration ,Interactive Journal of Medical Research).*

ABSTRACT

Background: Unhealthy lifestyle is predictive of degenerative diseases; however, their effect on health quality has not been examined in western Ethiopia. Therefore, the research was designed to study HRQoL and associated lifestyle factors of the middle-aged urban population in western Oromia.

Methods: A cross-sectional study was carried out among 266 adults from January 1 to March 2019. Questionnaires for lifestyle behaviors were adopted from health promotion and the EQ-5D was used to assess health-related quality of life (HRQoL). Data were analyzed using descriptive statistics, and multivariable regression analysis.

Results: The mean and SD of the age of participants was 52.5±11.5 years. Participants with poor HRQoL, low dietary diversity score, and physical inactivity were 24.4%, 68%, and 91% of the sample, respectively. Individuals with poor HRQoL had significantly (P<0.001) higher unhealthy lifestyle behavior scores. Multilinear regression model showed significant associations between physical activity, alcohol consumption, smoking, diet, and HRQoL. Physical inactivity (ß= 2.972; 95.0% CI: 2.32, 3.62; P<0.001) and unhealthy diet (ß= 0.043; 95.0% CI: 0.015, 0.070; P<0.002) showed positive significant associations with poor HRQoL. Conversely, alcohol drinking (ß=2.94; 95% CI (-5.79, -0.10); p=0.042) and khat use (ß=2.94; 95% CI (-5.79, -0.10); p=0.042)) showed negative associations with HRQoL. Poor lifestyle behaviors and poor HRQoL were also independently significantly associated (P=0.023). On Multinomial Logistic Regression analyses participants who had self-care difficulty had more than eleven times (AOR=11.563;

95%CI (4.495, 29.751; P=0.000*)) chance of having poor health-related quality of life than its complement.

Conclusions: Unhealthy diet, Physical inactivity, and other lifestyle factors were prevalent and significantly associated with deprived HRQoL. All domains EQ_D5 showed association with HRQoL. Lifestyle education is recommended to improve the health and quality of life of the middle-aged urban population in Oromia State Western Ethiopia.

Keywords: *Health-related quality of life, lifestyle behaviors, middle-age, Ethiopia*

2. INTRODUCTION

Quality of life (**QOL**) is a multidimensional concept that measures an individual's wellbeing. People living with chronic diseases can adversely affect their health-related quality of life (HRQoL) and it was a major contributor to health care costs (Hutchinson TA, *et al*. 1983). Non-communicable diseases have become major public health and socioeconomic problems in low-and-middle income countries in the 21st century. The prevalence of MetS has been reported as varying from <10% to 84%, depending on the socio-demography of the population (Daniel SR.2014, Rouf R, *et al*. 2008, American Heart A, *et al.* 2004). Adopting a healthy lifestyle contributes to good health and wellness (Kushner *et al. 2014*, Healthy People, 2020). Modifiable lifestyle behaviors include smoking, poor diet, physical inactivity, obesity, psychological ill health and alcohol consumption (FAO, 2013). Engaging in one or more of these detrimental lifestyle behaviors is associated with an increased risk of mortality (Loef M, and Walach H. 2012, Verschuren WM.*et al*. 2013, Martinez-Gomez D, *et al*. 2013).

Unhealthy lifestyle accounts for the most risky of non-communicable disease (NCDs). The effect of unhealthy lifestyle leads to less health-related quality, production, deaths, economic crisis, reduced individual productivity, cutoff routine work, to premature death(Spark Arlene J. 2007). According to a 2016 Ethiopian Public Health Institute report, the cumulative economic losses due to NCD burden in low-and-middle income countries between 2011 and 2025 has been estimated at US$7 trillion. Population norms for HRQoL are an essential source of information in health economics and in the evaluation of population health (Scuffham PA, *et al.* 2014).

The risk of NCDs is known to increase in the presence of unhealthy lifestyle factors, such as tobacco smoking, diets high in fat and calories, and physical inactivity (Li Zhang, *et al*. 2017). Many chronic diseases can be delayed, prevented, or managed through adopting healthy behaviors (Dietz, *et al*.,2016), yet unhealthy diets, physical inactivity, tobacco use, and alcohol consumption, are becoming increasingly prevalent in low-and-middle income countries that also face rapid economic and social development, urbanization, and industrialization. The importance of a healthy diet and physical activity in reducing rates of disease and death from chronic diseases has been well established (Hawkes C. 2013).In Ethiopia, metabolic syndrome is a major public health problem, with a high prevalence in urban areas, and in particular, in work site employees. However, no national investigation of this phenomenon has yet been reported.

Health-related quality of life is a measure that reflects an individual's subjective experience of their health status. HRQoL systematically measures the relationship between health and health status through the concept of quality of life (QoL). It is a dynamic multidimensional model consisting of three main dimensions: physical, social, and mental health (Testa MA and Simonson DC. 19963).

The EuroQoL 5D (EQ-5D) is an instrument for measuring quality of life and comprises the five dimensions of mobility, self-care, usual activities, pain or discomfort, and anxiety or depression. To improve the QoL in various populations and to reduce health inequalities, it is important to note that certain domains and the factors related to those domains may specifically influence a given person's HRQoL(Vogl M, *et al*.2012, Saffari M, *et al*. 2015, Van Reenen M and Oppe M. 2015).

Information about lifestyle factors and HRQoL is useful for planning health promotion programs that aim to raise awareness about the importance of lifestyle and to motivate the adoption of healthy lifestyles (Ferreira A, *et al*. 2009, Yamagami T, *et al*. 2005). Ensuring that HRQoL is equally distributed of across different social groups and regions is important for national, and global, equality. Hence, measuring and monitoring HRQoL in the general population is critical for developing appropriate health policy interventions to reduce social and geographical inequality in HRQoL throughout society (Shahab Rezaeian, *et al.*2017). Therefore, this study aimed to investigate the prevalence of HRQoL and associated lifestyle factors among the middle aged urban population of western Ethiopia.

3. METHODS

2.1. STUDY SETTING

A community-based cross-sectional study was conducted from January 01, 2019, to March 01, 2019, on 266 unscreened healthy adults in towns of western Ethiopia namely Nekemte the largest city in western Ethiopia. Nekemte is located 328 km from Addis Ababa, has a latitude and longitude of 9°5′N 36°33′E, and an elevation of 2,088 meters. For a detailed description of the study area(Chapter 2).

2.2. STUDY POPULATIONS

All apparently healthy individuals aged between 40-65years, lived at least six months before and additional six months after baseline data collection were recruited.

2.3. STUDY DESIGN

Community-based cross-sectional study design was implemented to assess the association between healthy lifestyle behaviors and HRQoL.

2.4. SAMPLING METHODS

The sample size was determined for each objective using effect sizes published in the literature, and the largest value was used as the study sample size. As there was no similar study had previously been conducted, the minimum sample size was calculated using the single proportion formula, using prevalence among healthy Ethiopian adults as the dependent variable. The most common indicator of metabolic syndrome is abdominal obesity, with 19.6% prevalence (Girma B, et al. 2011). Therefore, with a margin of error of 2 to3%, a confidence level of 95% and 10% for loss to follow-up, the minimum sample size was calculated to be 266 participants. Regarding sample frame, sampling methods and eligibility criteria please refer (Chapter 2 and 3).

2.5. DATA ANALYSIS

Data were analyzed using SPSS version 24 (IBM Corporation, NY, and USA). EQ-5D scores (Mobility, self-care, usual activities, pain/discomfort, anxiety/depressions) were calculated for each dimension. They were categorized as normal, some/partially and severely problem. To determine the association of HRQoL with independent variables, the outcome variable was

dichotomized into 1=poor HRQoL and zero (0) otherwise. Frequency, percentage and descriptive statistics were used to summarize the data and describe the characteristics of the sample. T-tests were used to assess differences associated with lifestyle factors. Correlation coefficients were used to quantify the relationships between nutritional status and socio-economic status, and between nutritional status and food consumption patterns. Associated significance was considered at a threshold of $P < 0.05$.

2.6. ETHICAL REVIEW AND CONFIDENTIALITY

Permission to conduct the study was obtained Jimma University on January 1, 2019 (See chapter 2 for detail description of ethical endorsement).

3. RESULTS

3.1. CHARACTERISTICS OF PARTICIPANTS AND LIFESTYLE FACTORS

The distribution of socio-economic characteristics and lifestyle factors were displayed in (Table4: 1). More than two thirds (68.0%) of respondents had low dietary diversity. The vast majority of participants (91.0%) engaged in low physical activity, 2.3% were current smokers, 9.8% were current drinkers, and 1.1% currently chewed khat. Overall, the majority of participants (83.9%) had two poor health lifestyle factors, and 8.3% had three or more poor health lifestyle factors (Table 3:2.1).

Table 3:2.1. Distribution of lifestyle behaviors among middle-aged, urban, Ethiopia. (n=266)

Variables	Categories	Frequency	Percentage (%)
History of Smoking	Current smoker	6	2.3
	Former, but quit now	21	7.9
	Never smoker	239	89.8
History of alcohol	Current drinker	26	9.8
	Former, but quit now	40	15.0
	Never	200	75.2

History of Khat chewing	Current chewer	3	1.1
	Former, but quit now	18	6.8
	Never	245	92.1
Dietary diversity	Low	181	68.0
	Medium	76	28.6
	High	9	3.4
Physical activity	Physical in activity	242	91.0
	Moderate-intensity aerobic	13	4.9
	vigorous-intensity aerobic	11	4.1
Gender	Woman	167	62.8
	Man	99	37.2
Total number poor health lifestyle factors based on EQ5_D5	0-1	21	7.9
	2	223	83.9
	≥3	22	8.3

Notes: Poor lifestyle factors comprised current smoking, high-risk alcohol use, low physical activity, khat chewing, & poor DDS. Adults should do at least 150– 300 minutes of moderate-intensity aerobic physical activity; or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week, for substantial health benefits (WHO, 2020).

3.2. SELF-REPORTED HRQOL

As shown in Table 3:2.2, 65 (24.4%) respondents had "poor" HRQoL as measured using the EQ-5D. The most frequently reported health problem was pain/discomfort (15.0%) followed by anxiety/depression (14.3%).

Table 3:2.2. EQ-5D scores among middle-aged urban residents (n=266) in western Ethiopia.

EQ-5D	Degree of problem	Frequency	percent (%)
Mobility	Normal	249	93.6
	Partially	17	6.4
Usual activity	Normal	253	95.1
	Partially	12	4.5
	Severely	1	0.4
Self-care	Normal	264	99.2
	Partially	2	0.8

Had Pain or discomfort	No	226	85.0
	Partially	40	15.0
Had Anxiety or depression	No	228	85.7
	Partially	38	14.3
HRQoL	Good HRQoL	201	75.6
	Poor HRQoL	65	24.4

EQ-5D: EuroQoL 5-dimensions; HRQoL: health related quality of life.

3.3. FACTORS ASSOCIATED WITH HRQOL

3.3.1. LIFESTYLE FACTORS

Adults with poor modifiable healthy lifestyle behaviors (smoking, alcohol or khat consumption, and low physical activity) had a significant overall HRQoL score (P < 0.001). The mean difference in HRQoL score was 2.88 for smokers, 2.65 for drinkers of alcohol, 2.91 for khat chewers, and 1.14 for people with low physical activity. Participants with poor dietary diversity had a smaller mean HRQoL difference, but this was still significant to P=0.003 (Table 3:2.3).

Table 3:2.3. Mean differences in HRQoL scores associated with unhealthy lifestyle behaviors among groups of middle-aged urban residents in western Ethiopia (n=266).

	Intervention vs Control (Mean ± SD)	95% CI	P
History of Smoking	2.88±0.40	(2.83, 2.92)	<0.001
History of Alcohol	2.66±0.65	(2.58, 2.73)	<0.001
Chewing Khat	2.91±0.32	(2.87, 2.95)	<0.001
Diet Diversity score	0.02±0.18	(0.01, 0.06)	0.003
Physical activity	1.14±0.47	(1.10,1.20)	<0.001

Values are presented as mean ± standard deviation. Statistical significance of differences was calculated using t-tests. Dependent variable: HRQoL (health related quality of life)

The results of the multilinear regression analysis are shown in Table 3:2.4. Being physically inactive (ß= 2.972; 95% CI: 2.32 to 3.62; P<0.001) and having an unhealthy diet (ß= 0.043; 95% CI: 0.015 to 0.070; P=0.002) had direct positive significant associations with HRQoL. Conversely, cigarette smoking, drinking alcohol, and chewing khat showed negative associations with HRQoL (β=-2.94, 95% CI-5.79-0.10; p=0.042). Compared to those with 0-1 unhealthy lifestyle behaviors, participants reporting two unhealthy lifestyle behaviors were more likely to have poor HRQoL (ß=4.95, 95% CI: 1.24,19.70).

Table 3:2.4. Multilinear logistic regression model predicting the likelihood of having poor HRQoL among middle-aged urban population in western Ethiopia, (n=266).

Variable	Categories	Unstandardized coefficient (ß)	P	95.0% CI
History of physical activity	Inactive	2.97	<0.001	2.32, 3.62
	Moderate	-0.55	0.031	-1.60, 0.51
	Active	1		
History of smoking	Current	-2.94	0.042	-5.79, -0.10
	Former	-2.94	0.042	-5.79, -0.10
	Never	1		
History of alcohol drinking	Current	-2.94	0.042	-5.79, -0.10
	Former	-1.34	0.060	-2.73, 0.06
	Never	1		
History of chewing Khat	Current	-2.94	0.042	-5.79, -0.10
	Former	-2.94	0.042	-5.79, -0.10
	Never	1		
Unhealthy diet	Yes	0.043	0.002	0.02, 0.07
	No	1		
Number of poor lifestyle behaviors	2	1.30	0.65	0.42,4.02
	≥3	4.95	0.02	1.24,19.70
	0-1	1		

Note: Healthy diet mean a food that have at least four major Vegetables and Fruits, Whole grains, Meat and Dairy. Unhealthy lifestyle: mean having one or more poor modifiable risk factors.

3.3.2. DOMAINS OF HRQOL

The results of the Logistic Regression analyses are shown in Table 3:2.5. Based on the finding of the study, participants with mobility problems(AOR=2.119; 95%CI (2.085, 6.820; P=0.000*)), self-care difficult (AOR=11.563; 95%CI (4.495, 29.751; P=0.000*)), Pain /discomfort (AOR=2.032; 95%CI (1.409, 7.564; P=0.000*)) and Anxiety/depression (AOR=1.892; 95%CI (1.342, 9.526; P=0.000*)) had more likely chance of having poor health-related quality of life than their counterpart.

Table 3:2.5. Logistic Regression analyses show predictor variables of HRQOL, Nekemte, 2019.

Poor HRQoL[a]		AOR	95% CI	P
Mobility problem	Yes	2.776	2.057, 3.747	0.000*
	No/Normal	1		
Usual activity problems	Yes	2.119	2.085, 6.820	0.815
	No/Normal	1		
Self-care problem	Yes	11.563	4.495, 29.751	0.000*
	No/Normal	1		
Pain /discomfort	Yes	2.032	1.409, 7.564	0.000*
	No/Normal	1		
Anxiety/depression	Yes	1.892	1.342, 9.526	0.000*
	No/Normal	1		

4. DISCUSSION

This study reports the results of a questionnaire about healthy lifestyles and their association with HRQoL as measured using the EQ-5D in middle-aged urban residents of western Ethiopia. This study also assessed the relationship between behavioral factors and HRQoL using a Multivariable logistic regression model for each group. Adults with unhealthy lifestyles reported lower HRQoL scores. Smoking, physical inactivity, poor dietary diversity, alcohol consumption, and khat chewing were all independently associated with poor HRQoL. This finding is in agreement with previous similar studies, demonstrating that an individual's risk of poor quality of life significantly increases when they engage in multiple unhealthy lifestyle behaviors (Verschuren WM, *et al*. 2013, Pearson WS, *et al*. 2010). The association of physical activity with HRQoL has also been demonstrated previously (Daniel SR.2014).

The finding is that physical activity, unhealthy diet, and multiple poor healthy lifestyle behaviors are associated with poorer self-reported health-related quality of life. This study is also in agreement with previous studies conducted in different settings (Kolt G., et al. 2013, Johnson ST, et al. 2013). Promoting physical activity and reducing sedentary behavior can help to achieve the 2030 Sustainable Development Goals (SDGs), particularly Good Health and Wellbeing (SDG3), and Sustainable Cities and Communities (SDG11) (WHO, 2020). As such, reporting

that the same association is found in middle-aged urban residents of western Ethiopia is a useful contribution to the existing literature.

Domains of HRQoL were strongly associated with health-related quality of life among middle adulthoods in West Ethiopia. This study is supported by a prior study in Arba Minch Town(Zeleke N, G., & Ayele M, T.,2020).

This cross-sectional study relied entirely on self-report through the use of questionnaires, and as such is subject to recall bias due to the nature of the unhealthy lifestyle practices being discussed (such as diet, including fruit and vegetable consumption, tobacco use, alcohol use, and physical inactivity). Respondents may have answered inaccurately when reporting socially unacceptable behaviors. Further, quality of life was also measured using a self-report tool, which might tend to under or overestimate the actual levels of certain risk factors. Report of physical activity could be improved by quantification by using a pedometer. Factors related to sleep behavior are often reported to be associated with quality of life but were beyond the scope of the present study. The target group of this study was only middle-aged urban residents, and as such these findings may not be generalizable to younger or older populations, or those in rural settings. Finally, more generalizable results may be found by studying larger samples and incorporating biochemical testing.

5. CONCLUSION

This study showed that the overall health-related quality of life was above average. This study demonstrated that in middle-aged urban residents of western Ethiopia, HRQoL decreased as the number of poor lifestyle behaviors increased. Unhealthy lifestyle behaviors were associated with poor HRQoL both independently, and in combination. Interventions targeting healthy lifestyle behaviors are needed to improve understanding of the impact of poor lifestyles within the urban population of Ethiopia to influence individual behaviors and to create synergistic improvements by introducing targeted behavior. Such interventions are needed to improve HRQoL in Ethiopia.

3.3. HEALTHY DIETARY PRACTICES AND ITS' ASSOCIATED FACTORS AMONG ADULTS IN NEKEMTE TOWN, OROMIA STATE, WESTERN ETHIOPIA.

Redrafted from: Alemu Adeba, Dessalegn Tamiru, and Tefera Belachew.Healthy dietary practice and its' associated factors among adults in Nekemte Town, Oromia National Regional State, Ethiopia. Volume 10 - 2023 | doi: 10.3389/fnut.2023.1259024.

ABSTRACT

Background: Adopting a healthy lifestyle remains a challenge worldwide. An unhealthy diet is the core risk factor for lifestyle illnesses. However, the status of a healthy diet and its predictors were not assessed in Nekemte town, which targets middle-aged adults. The study was designed to assess healthy diet, prevalence, and factors associated with healthy diet among middle-aged adults in Nekemte town from January 15 to February 30, 2019.

Methods: A descriptive epidemiological study design, typically a community-based cross-sectional study design was applied in Nekemte town to middle-aged adults. Primary data were gathered using a questionnaire and checked for normality. Factors associated with dependent variable were analyzed with logistic regressions, and their significance was determined at P 0.05.

Results: The status of unhealthy dieting practice was 73.31% in study area. This study showed that being from low-income household (P = 0.001), not married (p = 0.001), and having a daily meal frequency less than three times a day (AOR: 1.91, 95% CI: [1.04, 2.71]) were associated with unhealthy diets. The odds of having an unhealthy diet were almost three times (AOR = 3.20, 95% CI: 2.04, 5.98) higher for illiterate participants compared to literate participants. In addition, an unhealthy diet was nearly four times (AOR: 3.87, 95% CI: [3.23, 5.65]) higher for participants with poor knowledge of healthy diets compared to alert participants.

Conclusion: The researchers identified unhealthy diets was highly practiced by the study samples of Nekemte populations. Hereafter, community-based face-to-face lifestyle education through intensive participation of community leaders is highly recommended.

Keywords*:* Healthy dietary practice, prevalence, associated factors, adulthood, Nekemte,

1. INTRODUCTION

People consume diets for different reasons, like malnutrition prevention globally, and they are defined as amalgamations of foods (WHO, 2020). This food may be a healthy diet or an unhealthy diet that has a positive or negative impact on the human body. Poor diet practices were habitual in low-income countries, and from the four major risk factors of non-communicable diseases, an unhealthy diet has been related to those illnesses (Samuels T, *et al*, 2014, Gholizadeh, F. *et al,* 2018). Different researchers argued that this scenario is not only risky for metabolic syndrome development but also a potential risk factor for diseases like osteoporosis (Kate Terrio, *et al.* 2002).

Whatever the recommended healthy diet intake is, it is still under discussion. Only 42.56% of the countries in the world have their own dietary guidelines in world (FAO, 2016). Likewise, Ethiopia is at the initial stage of formulating the policy.

Evidence-based studies show that globally, people use the dietary diversity score to measure and indicate a good proxy of dietary quality (Arimond M.*et al,* 2011, Rawat, R. *et al*, 2013, Vandevijvere S. *et al*, 2010). It is known that people in low- and middle-income countries typically eat fewer food groups than their staple foods, resulting in a low dietary diversity score (Ruel MT. 2003). This is an arithmetical indicator of poor diet quality (Arimond M.*et al,* 2011, Dao MC.*et al*, 2019).

Regarding food items, about 75% of the Ethiopian diet is cereal-based monotonous feed (Rawat, R. *et al*, 2013, Workicho A. *et al,* 2016). Other studies reveal that the prevalence of low and medium dietary diversity scores among Ethiopian populations was 60% and 40%, respectively (Alemayehu S. *et al*, 2012, Goshu D. *et al*, 2013).

NCDs are rapidly increasing globally and emerging radically in East Africa among adults (Okafor CI. 2012). Diet adequacies were formulated for different age groups of adults, but findings identified that many adults still do not follow a healthy diet. It is noted that there has been no such investigation regarding the topic based on adults in west Ethiopia of a specific age.

Thus, the researchers are interested in investigating the status of healthy diet practices and associated factors among middle-aged adults in Nekemte populations from January 15 to February 30, 2019.

2. METHODOLOGY

2.1. NARRATION OF THE STUDY AREA

This study was conducted in the Oromia Region, western Ethiopia, at the hub of western Ethiopian towns (Nekemte town) to predict study populations' healthy diet practices and their associated factors. The study is located 328 kilometers west of Addis Ababa.

2.2. STUDY DESIGN AND PERIOD

A community-based cross-sectional study was conducted to determine the status of dietary practices and their predictors among adults from January 15, 2019, to February 30, 2019.

2.3. PARTICIPANTS

Selected samples from all middle-aged [41–64 years)] adult Nekemte populations and adults unfit for selection criteria were not eligible currently for the research.

2.4. DETERMINATIONS OF SAMPLES

The sample size was determined by using the formula [n = [(Za/2)2*P (1 − P)]/d2]. By considering a 95% confidence level of Za/2 = 1.96, a margin of error of 2%, and a proportion (p=19.6%) of central obesity, which is the most common component of metabolic syndrome among healthy Ethiopian adults (for details of sample size see Chapter 2).

2.5. SAMPLING DESIGN AND SAMPLING METHODS

The study setting was purposefully selected, and a probability sampling design was implemented for study participants. From six communes (administratively small sub-cities; locally termed Ganda or Kebele), one commune was randomly selected with a simple lottery method. To assure the relevance of the data, a third of the kebele must be selected. Additionally, another commune was assigned that is not adjacent to the former Ganda or Kebele but has a similar socio-economic status. A simple random sampling method was applied to select study participants.

2.6. DATA COLLECTION INSTRUMENTS

The data collection tool used well-structured Food Frequency Questionnaires. Questions contain socio-demographic and health diet mocks. The questionnaire can be implemented at the household or individual level, according to the purpose of the study. Trained data collectors, including researchers, collected the information sequentially.

2.7. DATA PROCESSING AND ANALYSIS

The developed instrument for dietary practices was used to assess it. 15 of the collected data points were cascaded based on standards. Adults' mean dietary score from information gathered from respondents. The data was described using IBM software, SPSS version 24. The findings were presented with frequency, percentage, and descriptive summaries used to explain the number of study participants in the analysis. Logistic analysis was performed to calculate the association between risk factors and significance level at a P-value of 0.05.

2.8. ETHICAL REVIEW

Ethical consideration was approved, taken from and an informed consent form was taken from the study participants (Chapter 2).

3. RESULTS

3.1. SUBJECT CHARACTERISTICS

From the 266 samples completed for the gender distribution, the majority of the respondents (186, or 69.93%) had unhealthy diet practices, and 62.78% were female. Among male participants, 71 (71.72%) had unhealthy diet practices (Table 4:3.1 and Chapter 4).

Findings revealed that 146 (54.89%) of the participants had a low income of 1.25 USD/69.76 ETB, and 209 (78.57%) adopted unhealthy dietary habits. Similar to nearly three-fourths of participants, 187 (70.30%) of the adults were illiterate, and of the total illiterate participants, 134 (71.66%) had an unhealthy diet (Table 3:3.1).

Table 3:3.1: Socio-demographic Distribution of Participants with Diet Practice, Nekemte, 2019.

Variable	Categories	Diet practices, n (%)	
		Unhealthy	Healthy
Sex	Female	115(68.86)	52(31.14)
	Male	71(71.72)	28(28.28)
	Total	186(69.93)	80(30.07)
Age group in years	41-48	119(82.10)	26(17.90)
	49-56	52(67.53)	25(32.47)
	57-64	29(65.90)	15(34.10)
	Total	200(75.19)	66(24.81)
Income (USD/person/day)	< 1.25 USD	110(75.34)	36(24.66)
	> 1.25 USD	99(82.50)	21(17.50)
	Total	209(78.57)	57(21.43)
Marital status	Not married	69(78.41)	19(21.59)
	Married	127(71.35)	51(28.65)
	Total	196(73.68)	70(26.32)
Educational status	Literate	51(64.56)	28(35.44)
	Illiterate	134(71.66)	53(28.34)
	Total	185(69.55)	81(30.45)

3.2. STATUS OF HEALTHY DIET PRACTICE

The overall prevalence of dietary practices assessed, for sure, indicated that 195 (73.31%) and 71 (26.69%) of respondents adopted unhealthy and healthy diets, respectively (Fig.3:3.1).

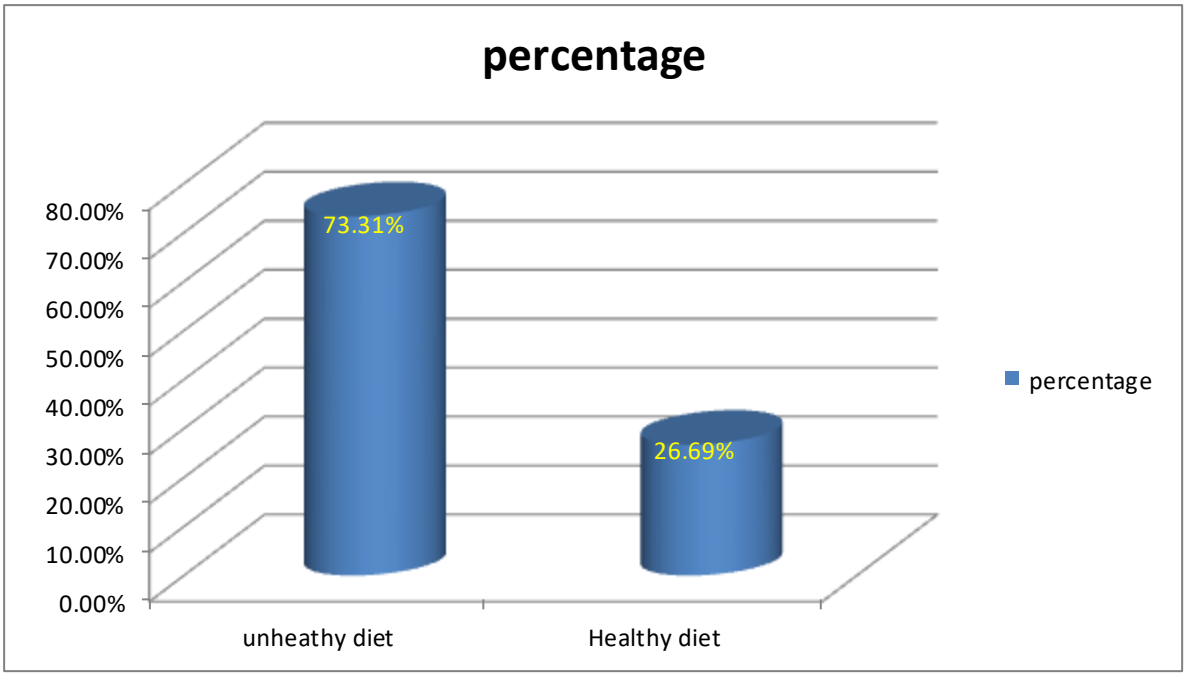

Figure 3:3.1. The prevalence of diet consumed by respondents in Nekemte town (n = 266), 2019.

3.3. FACTORS ASSOCIATED WITH DIETARY FOODS

On analysis, marital status, education, meal frequency, and income of participants demonstrate a relationship with the adoption of healthy foods among middle-aged Nekemte populations. Adults being having low-income households, being unable to read and write (Illiteracy), and having meal frequency less than 3 times per day were more likely significantly associated with unhealthy diet practices (AOR: 1.59, 95% CI: [1.37, 3.21], AOR: 3.20, 95% CI: [2.04, 5.98], AOR: 1.91, 95% CI: [1.04, 2.71], respectively). The odds of having an unhealthy diet were almost four times (AOR = 3.87, 95% CI: 3.23, 5.65) higher for having poor knowledge of healthy diets compared to knowledge participants (Table 3:3.2).

Table 3:3.2. Biviarate and multivariate logistic analysis findings of factors associated with a healthy diet (n =266), 2019.

		Dietary Practice				
Variables	**Categories**	**Unhealthy**	**Healthy**	**COR**	**AOR(95% CI)**	**P**
Sex	Female	115	52	0.87(0.25,0.97)	0.54(0.48, 0.87)	0.868
	Male	71	28	1	1	1
Income USD/per/day	<1.25	110	36	0.65(0.39,0.86)	1.59(1.37, 3.21)	0.001**
	>1.25	99	21	1	1	1
Education	Illiterate	134	53	1.39(1.05,2.97)	3.20(2.04,5.98)	0.047*
	Literate	51	28	1	1	1
Marital status	Unmarried	69	19	1.46(1.13,4.85)	0.59(0.52, 0.98)	0.001**
	Married	127	51	1	1	1
Has Urban farming	Yes	5	17	0.07(0.05,0.76)	0.40(0.32, 0.58)	0.576
	No	203	45	1	1	1
Meal frequency	<3/day	148	35	22.19(19.25,26.97)	1.91(1.04,2.71)	0.000*
	≥3/day	13	68	1	1	1
Knowledge on a healthy diet	Poor	123	44	4.68(1.89,7.57)	3.87(3.23,5.65)	0.001**
	Good	37	62	1	1	1

Notes: Significances considered at *p < 0.05, **p ≤ 0.001

4. DISCUSSION

This community-based study found that 73.31% of middle-aged adults adopted an unhealthy diet. Also, 183 (68.80%) of the adults had three or fewer meal frequency consumption patterns per day.

According to Darmon, N., and Drewnowski, A. (2008), the findings postulated that individuals with lower socio-economic status adapt and adopt unhealthy diets when compared to those with a higher one among adults in Australia (Darmon, N.; Drewnowski, A. 2008). Likewise, the

current study revealed that the healthy diet of participants was significantly associated (p 0.001) with the daily income of adults. This research outcome was also confirmed by studies done on Dietary intakes among US adults(Mozaffarian, D. *et al*, 2016) and in Australia (Livingstone, K.M. *et al*, 2017).

Also, a study in the UK agreed that participants from households reporting lower financial or food security (since the start of the COVID-19 pandemic in the UK in February 2020) had poorer diets in some respects than participants from other households (NIHR, 2020).

Having poor knowledge of healthy diets was strongly associated with having an unhealthy diet (AOR: 3.87, 95% CI: [3.23, 5.65]). Similar to this finding, having good perceptions and valuable knowledge regarding the healthy diet concept is critically necessary for allowing people to make the 'right life' choices. Another systematic review indeed suggests that nutrition knowledge is one of the factors that are most consistently related to a healthy diet (Guillaume, L., et al, 2010).

Healthy food access is significant for improving population health (Williams D.R. *et al*, 2016). However, we found that many populations adopt unhealthy diets, which are highly prevalent at the study site. Independent variables showed a significant relationship with dependent ones among adults. Finally, this research shows that, in addition to confounding, the distortion of the association between diet and risk factors cannot be generalized unless entire populations adapt and adopt healthy diets.

As this study has many strengths, it also comes with different limitations. The study was limited by a smaller sample size, biophysical and biomarker characteristics of respondents were not considered. Besides that, cross-sectional studies have limitations. This study plays a crucial role in policy reviews, putting direction for implementers' work on awareness creation for the adoption of a healthy diet and food security issues that boldly need great attention to measure the food quantity consumed with frequency. Besides, this study revealed that the adult diet throughout life is masked, so future research perspectives will study inculcating rural and urban populations in a nationwide context using the evidence.

5. CONCLUSIONS

This research revealed that the prevalence of unhealthy diet practices was high. And, majority of the participants had < 3 times the average meal frequency in a single day, and predicting variables were also associated with a healthy diet. WHO recommends that people should eat a combination of different foods, including staple foods, legumes, vegetables, fruit, and animal-source foods. On the contrary, almost all adults living in Nekemte Town practice cereal-based monotonous food. Therefore, for awareness creation about the adoption of a healthy diet and food security issues, we boldly need to pay attention to measuring the food quantity consumed with frequency. Besides, future research needs to study inculcating rural and urban populations nationwide.

3.4. BARRIERS AND FACILITATORS IN ADOPTING HEALTHY LIFESTYLES IN WEST ETHIOPIA: A QUALITATIVE STUDY.

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ABSTRACT

Background: Risks of NCDs are prevented by adopting healthy lifestyles, but it remains a matter of concern, and the knowledge regarding the effect of social factors on health is almost not researched in West Ethiopia.

Objective: To explore barriers and facilitators in adopting healthy lifestyles among urban residents of West Ethiopia.

Methods: A qualitative study design was used with three diversified focus group discussion (FGD) guidance to obtain the adoption and perception of 27 participants on healthy lifestyles. The collected audio record and session note data; were transcribed; verbatim and qualitatively analyzed through a thematic approach.

Results: Based on social capital perception frames (bonding, bridging, and linking) the following themes were identified. **Barriers theme**: negative influence from family, peer pressure and perceive towards unhealthy lifestyles &obesity, and accepted socialization by the community (bonding); inadequate awareness on NCD screening and management and insufficient support from health care workers (bridging); and hospital & community healthcare professionals related barriers, inequity in the allocation of public resources (linking). **Facilitators' themes:** motivation to participate in physical activity (bonding); cooperative relationships with health extension workers (bridging); and fear of morbidity and mortality; access to media to an aware healthy lifestyle (linking); were identified themes to healthy lifestyle adoption.

Conclusion: This study revealed that unhealthy lifestyles were adopted by urban residents of West Ethiopia. Bonding, bridging, and linking social capital would work as barriers and

facilitators to adopt healthy lifestyles. Therefore, integrating quoted findings into the chronic care system needs attention.

Keywords: *Healthy lifestyles, Adoption, Social capital, Qualitative analysis*

1. INTRODUCTION

Degenerative diseases are a major public health concern worldwide, including Ethiopia. Two-thirds of NCD mortalities occur in low-income developing countries that lack health literacy and resources (Abegunde DO *et al*. 2007). NCDs, particularly obesity, cardiovascular, diabetes, cancer, hypertension, stroke, and respiratory diseases, and their risks are the main causes of morbidity and mortality globally (Abegunde DO *et al*. 2007). NCDs, particularly obesity, cardiovascular, diabetes, cancer, hypertension, stroke, and respiratory diseases and their risks are the main causes of morbidity and mortality globally (Mensah, G. A. 2016; Fatt, Q. K. 2016; Cowan MJ, *et al*.2011; WHO, 2015; Daniels SR, *et al*.2005). Chronic diseases can be delayed, prevented, or managed through healthy lifestyles (Siddique MS, et al.2009; WHO, 2010; Dietz *et al*.2016).

Lifestyles adoption increases life expectancy by 0.5 years while metformin by 0.2 years. Associated morbidities such as blindness, end-stage renal disease, amputation, stroke, and coronary heart disease were decreased by greater percentages with lifestyle rather than metformin intervention, so lifestyle intervention provided greater health benefits at a lower cost than the metformin intervention(Zhang, P., *et al*. 2005).

Lifestyle diseases share risk factors similar to prolonged exposure to four main modifiable lifestyle behaviors: smoking, unhealthy diet, alcohol abuse, and physical inactivity. The combination of the main healthy lifestyle factors: maintaining a healthy weight, exercising regularly, following a healthy diet, and not smoking seems to be associated with as much as an 80% reduction in the risk of developing the most common and deadly chronic diseases(Engelen, L., *et al*. 2017).

Studies verified that a healthy diet plus 150 minutes of moderate intensity, or 75 minutes of vigorous-intensity physical exercise for three to five days per week, incorporating aerobic and strengthening exercises, improves health(Sallis, R.2017; Taylor, D. 2014; WHO; 2004). A study conducted on adherence levels to dietary recommendations for chronic care was poor among Ethiopian patients. For instance, in Addis Ababa, 51.4% of poor diet adherence was registered (Worku A, *et al*.2015) while a high percentage (74.3%) of poor adherence to dietary recommendations among patients with T2DM in Northern Ethiopia (Ayele *et al*.2018).

Another bottleneck to the adoption of healthy lifestyles was a lack of physical activity protocol, no skill, and standard receipts. Because of these, our people use unstandardized doses of salt, sugar, and other substances. For example, standard doses of alcohol for males are two standard drinking while one for females. Two standard drinks are equivalent to 25 ml spirits (like whisky, vodka, and brandy) or one standard glass (125 ml) wine or 340 ml beer. The main recommendations for a healthy diet are sufficient daily consumption of fruits and vegetables (≥ 400 g) and restricted consumption of free sugars (< 10% or, ideally, < 5% of total daily energy intake), fats (< 30% of total daily energy intake from total fats, < 10% total daily energy intake from saturated fats) and salt (< 6 g daily or one teaspoon) (WHO,2016).

In Ethiopia, the epidemiological behavioral risk factors (tobacco use, alcohol consumption, and khat chewing) showed that 7 % of men use tobacco products; 45% of women and 53% of men reported drinking alcohol in their lifetime; 11% of women and 28% of men reported that they have ever chewed khat(EDHS, 2011). Another study in Addis Ababa reveals the prevalence of Mets was 14.0% in men and 24.0% in women(Girum T,2014). Elevated blood pressure is more common in females (44.5%) than in males (34.9%) (Abda *et al*.2016).

The impact of unhealthy lifestyles not only undermines the quality of life, life expectancy, and productivity but also contributes to death and economic losses. Escalating rates of obesity in the U.S. have resulted in higher direct and indirect economic costs. Direct medical costs include prevention, diagnosis, and treatment related to obesity. Indirect costs are further subdivided into morbidity and mortality costs. Morbidity costs represent lost income from reduced productivity,

restricted physical activity, absenteeism, and bed days. Mortality costs encompass lost future income due to premature death (Spark, Arlene J, 2007; Hirakawa Y, *et al* 2018).

In our country, engaging the community in healthy lifestyle adoption was low, and also health and nutrition information desk for the awaking community on it is not sated yet. The population debunking of the myths and misconceptions of the diseases is another barrier wing. For example: NCDs are diseases of:

"Rich and affluent; Gibto Areki and moringa cure hypertension....; other bottlenecks".

Several qualitative studies have been conducted in Ethiopia to explore people's lifestyles and behavior about Communicable diseases. However, no qualitative studies have ever explored barriers and opportunities to adopt healthy lifestyles and prevent NCD through social capital perspectives, while such studies have been conducted in other countries (Hirakawa Y, *et al* 2016).

The underlying causes of unhealthy lifestyles which induced a high prevalence of NCD risk factors among residents were investigated. In-depth exploration of barriers and facilitators to adopting healthy lifestyles for improving modifiable risk factors of chronic illness needs integrated community, nutritionist/dieticians, physicians, sports experts, teachers, general practitioners, health officers, and nurse's team. For interpretation, we used a social capital framework with bonding, bridging, and liking categories to elucidate barriers and facilitators to adopt healthy lifestyles among urban residents of West Ethiopia.

2. Methods

2.1. *Study design and area*

This study was designed to explore barriers and facilitators in adopting healthy lifestyles among urban residents in urban residents in west Ethiopia: qualitative analysis through social capital perspectives with the provision of class survey, FGDs, and session notes. Because of the hub center for western towns (Assosa, Ambo, Bure-Bahirdar, Metu, and Jimma), this study was conducted in Nekemte City which is located at a distance of 328 km from Addis Ababa.

2.2. Participants

With non-probable sampling, participants were purposely recruited through health extension workers, who knew the residents' lifestyles and social backgrounds well. The participants were purposively selected from health professionals, known chronic disease patients, undiagnosed

communities, teachers, business bankers, community leaders, and office workers. According to(Degu G, &Tegbar Y. 2006), a minimum 27 sample size was calculated from three groups with 6-12 members each needed among adults 41 to 64 years. Homogenous group composition was divided into three age-stratified groups with the concept of life expectancy and biological change about menopause age: [41-48, 49-56 and 57-64] years old with comprised of 10, 9 and 8 participants respectively keeping the data saturation. Three individuals experienced in qualitative research methods were involved in leading, collecting, and analyzing the focus group discussions to do sound research.

2.3. Analysis

To manipulate the analysis, cascading of the number of participants by code who mentioned a particular theme was performed as the best indicator of the prevalent theme (Thairu L *et al*, 2007). Audio-recorded files were transcribed. Each session notes and focus group data were entered into Microsoft Word for open coding analysis by three coders. To illustrate the analysis, audio and direct quotes used in this text by the participants are transcribed into English verbatim, serving as a description of the topic explored. The qualitative data were analyzed through social capital perspectives with bonding, bridging, and linking frameworks.

2.4. Focus Group Discussions

Three focus group discussions (FGDs) were conducted in February 2019 at the Chelelik clinic compound. An FGD guide was designed to cover the common scale of healthy lifestyle adoption, containing five main domains (Table 3:4.1).

Table 3.4.1. FGDs guide line to assess status of healthy lifestyles adoption

Domains	*Probe/Questions*
(1) Dietary diversity	*Food groups (what, how often, role of DD, when, & where)?*
(2) Physical activities	*PA (Why, how often, effect on health, & where)?*
(3) Substance use (Smoking, alcohol, cannabises, Chat etc.)	*Doses and responses? , Effect on social health? What are the barriers and facilitators to use or stop?*
(4) Health seeking behaviours	*Why seek?, where get and by whom you cared? Any barrier?*
(5)Awareness & perceptions to prevention & care of NCDs	*Do you know NCD? , mention barriers to adopt healthy lifestyles, your perception to early detection and care of NCD?*

This guideline provided the arbitrator with the framework for raising topics, and participants were expected to express their perception and practices of adopting healthy lifestyles or not and discuss are barriers and opportunities to adopt healthy lifestyles. All the FGDs were conducted in Afan Oromo and moderated by Amharic in selected discussion rooms. Evidences were captured in photos, and key issues raised in the discussions were noted, and the discussion continued until no new issues were raised, or saturated for 60–90 minutes.

Text data were analyzed by thematic approach, which contains the following steps: 1) Audio and notes translated into English verbatim including direct quotes; 2) Familiarization (the principal investigator read thoroughly and repeatedly the original Afan Oromo transcript to get the concept); 3) Identifying and defining themes guided by study objective; 4) Generating initial codes; 5) Narrating and reviewing themes; 6) Reporting the findings.

2.5. *Familiarization*

The first author repeatedly read the original Afan Oromo transcript to obtain the whole sense of the FGDs. Expert English linguists read the summary of FGDs translated by qualitative data researchers and analyzers.

2.6. Generating initial codes

The first author generated the initial codes from the original Afan Oromo transcript. Then those initial codes were translated into English and shared with all the analysts. Both promoters reconciled differences and finalized the coding scheme.

In this study, the coding process holds both inductive and deductive approaches. Initial coding was performed by assigning cohesive chunks of text, to broadly explore the opportunities and barriers to adopting healthy lifestyles. During this process, we found that most of the findings of the study were booming with social capital theory. Thus, we applied the social capital framework to investigate the additional codes.

In the present study, social capital is a set of shared values that allows individuals in a group to work together effectively to achieve a common purpose, and it is an appositive product of human interaction (Will Kenton, 2019). For other scholars, social capital was defined as “social connections and the attendant norm and trust” and classified as bonding, bridging, and linking (Putnam RD, 1995; Szreter S, & Woolcock, 2004). Bonding social capital refers to the strong ties with individuals who are homogeneous in social composition (have similar interests and

goals), whereas bridging social capital refers to the weak ties with individuals who are heterogeneous in social composition. In this study, we defined bonding as strong ties with family or close friends and bridging as the networks at the community level. Linking social capital was defined as the district, provincial, and national level issues, such as the vertical ties between people with the local and central government.

2.9. Identifying and defining themes

Themes were finally created to link the categories and map the whole thematic system. Table 3.4.2, illustrates the process of themes generated from the transcribed text by showing some examples.

Table 3.4.2 Review trial example of generating themes from text

FGDs	Group of age 41-48	Group of age 49-56	Group of age 57-64
Text	"I have no choice…we are good friends, especially those who has been so for a long time. If they drink morethan two bottle of alcohol, how can I just drink half?"	"I know smoking is harmful …I fill in good mood... when I smoke full packet."	"I really hope that…of course you can do an intervention here…I hope that you professionals could give us acceptable and feasible suggestions, to make us healthier. We need more knowledge to change our lifestyles. We all still like to put a lot off oil and salt when cooking. We know we can not drink too much, but we still like drinking."
Codes	I need to drink a lot to keep good relationship with friends.	There is lack of chronic diseases health care workers in community.	We have some know how about healthy lifestyles, but we don't know how to do. We did not have procedures/protocols
Sub-category	Peer pressure	Inequity in allocation of public resources	Insufficient support from health care professionals
category	Bonding social capital	Linking social capital	Bridging social capital
Theme	***Barriers for adoption of healthy lifestyles***		
Texts	"Yes! When I was	"In the last decade I	

	young, I had to work and look for physical activity, but since there is not it is impossible. Now, I am living nearby to engage".	didn't know it (healthy lifestyle), now I understand how important it is.	
Codes	Since my home nearby to private sport club it helped me engaging to regular exercise	Nowadays health knowledge is disseminated through many ways, such as TV and radio.	
Sub-category	Motivation to participate in regular exercise	Awareness about healthy lifestyle given nationwide through media.	
Category	Bonding social capital	Linking social capital	
Theme	***Opportunity for adopting healthy lifestyles***		

Reporting

Colourful and persuasive examples from participants' conversation in FGDs were selected and presented in the form of quotes, for accurately illustrating our findings.

Ethical consideration

This study was approved by the Institutional Review Board (IRB), Institute of Health, Jimma University (Approval No. IHRPGY/596/2019; January 1, 2019). Consent of each participant was obtained before the study. Data were analyzed anonymously and quotes were shown with participant codes instead of the names.

3. RESULTS

Participant characteristics

The basic information (Gender, age, occupation, job categories) of participants were obtained before the FGDs conducted from 27 participants. Majority of the respondents were 41-48 years aged (37.04%), male (55.56%), and employed (77.78%) (Table3:4.3).This means unfortunately the selected one has little information that initiates them.

Table3:4.3. Socio-demographic characteristics of middle aged of urban residents, Ethiopia,2019

Variable, n=27	Categories	Frequency(n)	Percentage (%)
Age	41-48 years	10	37.04
	49-57 years	9	33.33
	58-64 years	8	29.63
Gender	Male	15	55.56
	Female	12	44.44
Occupation	Employed	21	77.78
	Unemployed	8	22.22
Job category	Business Bankers	2	7.41
	Health professionals	11	40.74
	Teachers	3	11.11
	Office workers	3	11.11
	Self employers/less	8	29.63

Theme Categorization

Theme 1: Barriers

The analysis applied three types of social capital: bonding (i.e. strong ties with individuals who are homogeneous in social composition, such as with family members, community sport club and close friends), bridging (i.e. weak ties with individuals who are heterogeneous in social

composition, such as health care professionals) and linking such as health care system (i.e. vertical ties with the regional and federal government) (Table 4).

Theme 2: Facilitators

Fear of morbidity and mortality, limited awareness, cooperative relationships with health extension workers and motivation to participate in physical activity are identified themes. Narration of themes, categories, and sub-categories materialized, and direct quotes of the participants were shown (table3.4.4).

Table3.4.4. Summary of themes, categories, direct quotes of urban residents, Ethiopia, 2019

Selected codes	Sub-categories	Categories	Themes
In our home a lot of salt & oil added, I consume daily saturated oil/fat & salt	Negative influence from family	Bonding social capital	Barriers of healthy lifestyles adoption
Not-enough vegetables & fruits	Inequity in demand &supply of materials	Linking social capital	
I drink a lot to keep good relationship with my friends.	Peer pressure	Bonding social capital	
It is perceived as reach person for an adults to get obesity	Trend /custom towards unhealthy lifestyles	Bonding social capital	
Lack of health care workers in the community health canters.	Inequity in allocation of public resources	Linking social capital	
We have some know how about healthy lifestyles, but we did not have protocols	Insufficient support from health care professionals	Bridging social capital	
Lack of community health care provider	Inadequate training on NCD screening and management	Bridging social capital	
I didn't have schedule for risk diagnosis	Lack of knowledge & skill on chronic Care	Linking social capital	

Home nearby sport club helped me to engage in regular exercise	Motivation to participate in regular exercise	Bonding social capital	Opportunities for healthy lifestyles adoption
HEWs are good. They help us a lot on nutrition education.	Cooperative relationships with health extension workers	Bridging social capital	
Some of us know role of adopt healthy lifestyles	limited awareness about healthy lifestyles	Linking social capital	

Theme1: Barrier of adopting healthy lifestyles

Bonding social capital

1. *Negative influence from family*

Closely living people influence one another in the adoption of lifestyles. Both female and male participants reported the dietary decision-making to purchase and prepare for their families was the responsibility of women. Adding excess saturated/clotted oil, salt, and sugar to family dishes and eating an 'unhealthy diet' were common. For example, one respondent blamed his assistant food cooker for inadequately adding oil and salt to the dish.

"Our housemaid uses excess oil to braise onions. I quarrel with my wife. We eat visible floating fat on the dish. Always my stomach cramps and I feel heartburn after eating meal. " (Team_3, male, 57-64 years-old group)

A female participant mentioned that substance use such as smoking, drinking alcohol, chewing chats, and cannabis, were shared with all family members. If someone uses substances at home, everybody in the same family develops a bad attitude.

"My husband keeps saying that it would be possible for him to fast more days but impossible to withdraw from drinking… many dependent people are living in the house, if he did not stop, we could depicted as food insecure. Even with a consequence, my two boys were in line too. Our salary was not enough to afford healthy food for the family." (Team_1, female, 41-48 year-old)

2. *Peer pressure*

People may adopt risky behaviours such as smoking, over-drinking and over-eating, as they want to be recognized by their peers. Participants believed that entertaining relatives or friends

in a restaurant and drinking a lot of alcohol were necessary to earn respect of their guests and maintain the good relationship with them.

"I have no choice…we are good friends, especially those who has been so for a long time. If they drink one bottle of alcohol, how can I just drink half?" (Team_3, female, 57-64 years-old group)

Participants perceive towards Overweight and obesity

Custom towards unhealthy lifestyle of the members of the close network made community think that it would be all right to adopt risky behaviours. For example, most of the participants accepted that it would not be a problem for adult to be obese. The high tolerance of family and friends towards obesity would decrease the motivation for changing behaviours.

"We are adult enough. Being obese is sign of doing well and it is ok for adult people. We don't care." (Team_3, male, 57–64 years old)

One of the respondents elaborated "We feel healthy. Now I am 51 years old, I have not diagnosed before. We do not have as such detailed knowledge. Also cost for diagnosis is high." (Team_3, male, 57–64 years old)

"Financial reasons" emerged as a major barrier to a healthy diet. For instance, one respondent stated, "not being able to afford it, money is something that can prevent you from physical activity." Some participants also stated that "healthy diet costs more," "lack time to cook," and "fast food is cheaper" as barriers to healthy eating habits. (The former: Team_2, male; 49–56 years old; the latter: Team_1, female; 41-48 year-old)

3. Accepted socialization by community

Human beings are social creatures and they all participate in the network of social relationships. Starting from ancestors to nowadays, our community accepted coffee ceremony as a means of socialization, cultural value and welcoming guests. Preparing coffee minimium of two times a day and drinking at least three cups of coffee serve in each period is common practice. They usually added a lot of sugar in each cup of coffee and the dose of caffeine did not measured. One person stated:

"I cannot drink coffee without added sugar, I like sweaty products like cake .Not only me, my collegues also too. I have a cup of coffee at home only when sugar is available." (Team_1, male; 41-48 year-old)

Bridging social capital

1. *Insufficient support from health care professionals Custom*

Participants from three FGDs precisely explained the strong motivation for changing behaviors, although they felt that they could not succeed without professional support from healthcare workers. They thought that their health knowledge was too little to adopt healthy lifestyles.

"I hope that…of course, you can do an intervention here…I hope that you professionals can give us acceptable and feasible suggestions, to make us healthier. We need more knowledge to change our lifestyles. We all still like to put a lot of clotted oil and salt when cooking. We know drinking too much is harmful, but we still like drinking. We know substance use is dangerous, yet we are using few substances like chat." (Team1, female, 41-48 year-old)

2. *Inadequate awareness on NCD screening and management*

Participants illustrate poor health information coverage as a barrier to healthy lifestyles adoption: "*…mass media coverage on importance of healthy lifestyles adoption, like health and nutrition registration, radio, television (TV), newspaper, and mobile short message service (SMS) is inadequate. We think the awareness created by health care workers to community on the health benefits of healthy lifestyle is insufficient."*(Team2, male, 49-56 year-old)

Linking social capital

1. *Hospital related barriers to adopt healthy lifestyles*

Insufficient infrastructure and lack of professionals in the hospitals were mentioned by the respondents as a barrier: *"…there is no aerobic and gym, active physical assessment center, metabolic syndrome therapy center, and trained professional in dieticians for nutrition council, physiotherapy and sport nutrition expert for exercise referral*."(Team2, male, 49-56 year-old)

The respondents indicated the lack of physical activity protocol or guidelines prevents the use of physical activity to prevent and control NCDs:

"*…physical activity tools that help health care workers by type, intensity, duration, and frequency of physical activity to be prescribed to patients is lacking in health institutes."* (Team3, male, 57-64 year-old)

2. *Community related barriers to adopt healthy lifestyles*

Due to food insecurity (availability and adequacy), people practice unhealthy diet such as clotted oil. Because of this:

> "*I and my family consume vegetable once a week..., and occasionally fruits."* (Team3, male, 57–64 years old) .In addition they consume cereal based monotonous foods regularly, for instance respondent raise: "*we… always eat Injera with shiro wett*." (Team$_2$_male; 49-56 year-olds). Other respondent continued …." Because of lack of time I eat unknown source food in restaurant." (Team2, female, 49-56 year-old group)

Majority of the participants believed they did not exercise enough, while many participants acknowledged the importance of regular physical activity. Most of the respondents gave simple and concise responses such as *"yes [don't have enough exercises]*" and "*I feel like I'm not having enough activities*." Some participants elaborated that their beliefs were the reasons of physical inactivity. For example, one participant said "*I don't have enough exercise. I feel like I don't have sufficient time for exercise, I work*." (Team1, male, 41-48 years old)

"Financial reasons" emerged as a major barrier to a healthy diet. For instance, one person stated "*not being able to afford it, money is something that can prevent you from physical activity.*" Some participants also stated "healthy food cost more," "[being] busy," and "fast food, literally fried biscuit is cheaper" as barriers to healthy eating habits. Lack of free time was revealed as a key subtheme relating to insufficient enough regular exercise. "Time," "work" and "lack of awareness" were common responses when asked about what prevented participants from exercising.

3. *Inequity in allocation of public resources*

Inequity in allocation of public resources: due to lack of incorporating healthy lifestyle adoption into urban health policy to access good quality of health services. Participants complained that the city did not have community health care workers than HEWs.

"Generally speaking, (unlike developed countries), our doctors are not so impolite, but problem is too few doctors and busy by routine work. There is less attention to NCD prevention through community based healthy lifestyles education." (Team_2, male, under 49-56 years-old)

4. *Barrier related to healthcare professionals to adopt healthy lifestyles*

One respondent indicated that the lifestyles of healthcare providers is the other barrier to adopt it into their work: *"…most healthcare providers may not have active lifestyles may be due to lack*

of time, skill, confidence, knowledge, and prioritizing clinical matters which may enable them not to use physical exercise in the healthcare system."(Team1, male, under 41-48years-old)

The respondents reflect experience of health care workers associated with healthy lifestyles adoption is not model for community. A male participant indicated;

"…*experience can be a barrier to integrate physical exercise in the healthcare to treat NCDs. For instance, lack of practical experience on the type, duration, intensity, and frequency of exercise to be integrated in healthcare to prevent and control NCDs is barriers among healthcare professionals."* (Team3, male, under 57-64years-old)

Theme_2: Opportunities to adopt healthy lifestyles

Bonding social capital

1. *Motivation to participate in regular exercise*

Motivation to engage into regular exercise occurred when participants had many friends who have similar interest. Sports clubs, such as riding horse, running, swimming, usually involved in many people with the similar health goals. Participants remarked that the community team sports helped them to engage into physical activity.

"Yes! When I was young, I had to look but my home is far from sport club, so it was impossible to participate in community sport club. Now due to opportunity living in condominium (home nearby sport club), it helped me to engage in regular exercise."(Team3, female, 57-64 year-old)

Bridging social capital

1. *Cooperative relationships with health extension workers*

Respondents mentioned the cooperative relationship with health extension workers, which might encourage their health seeking behaviour and enhancing healthy lifestyles campaigns. *"Health extension workers cooperate with each other in our town."* (Team1, male, 41-48 years old) *"The health extension workers are very nice! Just like our family. We like them."* (Team2, female, 49-56year old)

Linking social capital

1. *Fear of morbidity, mortality and medical help seeking*

An important factor that appear from the participants was fear of morbidity and mortality due to a symptomatic degenerative diseases and participants take care of themselves. They had an

understanding that by keeping the levels under controlled, it could be prevented. All the participants agree on the importance of early screening before become ill. Nevertheless due to the expensive, limited knowledge and time consuming hospital visits, they could not afford frequent follow ups. Hence, most of them did not visit doctor unless they were very sick. One person expressed the fear and his experiences as follow:

> *"I take care of my lifestyles modification, medications and checking my sugar levels before every meal…. I don't want to die early. I want to live for my family."* (Team1, male, 41-48 years old)

Limited awareness about healthy lifestyles and NCDs

Linking social capital included awareness of healthy lifestyles nationally. Participants stated the levels of awareness were limited due to various health policies and its implementation.

"Formerly, I didn't know it (healthy lifestyles), now I understand how important it is. Nowadays we have limited knowledge on it; some of us hear it through TV and radio, and health extension workers. We all know what should be done in order to live longer, but in the old days, nobody heard of that." (Team3, female, 57-64year old).

5. DISCUSSION

We identified barriers and facilitators in adopting healthy lifestyles among urban residents in West Ethiopia. Bonding, bridging, and linking social capital would work as facilitators to adopt healthy lifestyles, as seen in awareness creation and made cooperative relationships among health extension workers. Conversely, social capital also works as a barrier, such as perceived barriers to adopt a healthy lifestyle like "financial reasons" which emerged as a major barrier to a healthy diet, and peer pressures to continue over-drinking. This encourages the adoption of a healthy lifestyle at family as well as community level.

This study reveals the following findings. First, the lack of affordable unsaturated oil, lack of fruit & vegetable availability, and economic problems to purchase were major barriers to adopting a healthy diet. Second, lack of knowledge & skill in chronic Care (For instance: barriers related to participants believing getting obese at adult age is normal). Finally, a lack of community healthcare workers and inequity in the allocation of public resources were observed. Our study narrated barriers and opportunities in adopting healthy lifestyles as of domains stated in focus group guides.

Barriers related to diet were raised from lack of knowledge, economy, and availability of resources like unsaturated oil, fruits, and vegetables. Due to food insecurity, most people consume saturated oil and cereal-based monotonous food. Also, almost all respondents indicated they did not eat fruits because of their expenses and unavailability. For example, 1 kg of apple and banana were 100 and 30 Ethiopian birr respectively. This result was similar to the finding of perception and practice of a 'healthy' diet for non-communicable diseases (Nagoya J.et al. 2018).

As urbanization increases physical activity decreases and sedentary life increases. In healthcare, the lack of practical guidelines on how to prescribe physical exercise is another barrier. Previous research demonstrated that healthcare professionals who use physical exercise guidelines, use physical exercise to treat NCD patients more confidently than those who are not using it (Brien. *et al*. 2017).

The findings confirm there are barriers regarding marginalizing professionals from hospitals, lack of chronic health workers and physical activity prescription hinder to prevent risk factors. A similar study conducted supporting the idea that the lack of physical activity protocol in the Ethiopian health care system possibly implies the lack of knowledge about the health benefits of physical activity among policymakers, and absence of physical activity as a strategy for NCD prevention in the national health policy (Melkamu. *et al*. 2018). In contrast, a study in America reported the presence of guidelines and physical exercise in all medical schools in the USA (Lobelo. *et al*. 2018).

Bonding social capital provides intensive support to individuals (Szreter S, &Woolcock M, 2004), , and it is expected to play a significant role in adopting healthy lifestyles, such as reducing salt intake and exercising regularly. Several studies indicated the role of social capital in adherence to healthy lifestyles. For example, a Dutch study shows people with a high level of neighborhood social capital were more likely to be physically active and non-smokers (Mohnen SM, et al.2012). According to WHO (2010), physical activity: 23% of adults aged greater than 18 years insufficiently engage in moderate-intensity physical activity (< 150 minutes) per week.

In developed countries NCD services are preferably delivered in an established NCD clinic with a team of experts. Though, in our current placement of health facility structure and staffing it is impossible to have liked this ideal scenario. It is recommended to integrate healthy lifestyles education in to health post with primary prevention of diseases.

In developed countries, NCD services are preferably delivered in an established NCD clinic with a team of experts. Though, in our current placement of health facility structure and staffing it is impossible to have liked this ideal scenario. It is recommended to integrate healthy lifestyle education into health posts with primary prevention of diseases.

We identified barriers concerning the health system, patients, and professionals to prevent and control NCDs. Health care workers/ general practitioners did not prescribe healthy diet and physical activity because of the absence of protocol. The community has limited knowledge of diagnosis and early identification of risk factors for chronic diseases. A study conducted in Sydney focused on particular lifestyle risk factors of obesity, tobacco, and alcohol support our study. Due to the Lack of dedicated clinical guidelines and protocols for primary care, only a small proportion of primary care visits include risk assessment, provision of information, or support for behavioral change(Harris M., 2009).

To sum up, the lack of promoting healthy lifestyles through media alone, improper placement of health facility structure and staffing, lack of community coaching, unavailability of (fruits & vegetables, unsaturated oil, salt adequacy measurement), food price inflation, and lack of public awareness creation do not secure without coaching leadership implementation and policy advocacy.

6. Conclusions

Our findings demonstrated that bonding, bridging, and linking social capital could work as barriers and facilitators for adopting healthy lifestyles in urban residents of western Ethiopia. Due to different barriers stated in the above social capital frameworks, unhealthy lifestyles are practiced by the community. So, it implies face-to-face education is needed to adopt healthy lifestyles and prevent noncommunicable diseases.

Implications

The results of this study bring valuable insights for the further development of health lifestyles education. Financial reasons and the lack of available time were the main determinants for people to engage in a healthy diet and physical activity. The government needs to undertake food insecurity. Increasing the availability of affordable healthy foods like polyunsaturated fatty acid oil, fruits & vegetables, and opportunities for physical activities in communities are essential for having healthy lifestyles. Another bottleneck is the lack of community health care workers that give awareness on the effect of healthy lifestyles education on metabolic syndrome and quality

of life. Due to the lack of health and nutrition information desks in all institutes, people also have limited knowledge of early screening, prevention, and self-management of NCDs.

The identified barriers are indicators for policymakers to plan, design, and implement effective healthy lifestyles adoption into the chronic care setting and to redesign the existing health policy. Besides that, training of health care workers on healthy lifestyle adoption, physical exercise prescription, and metabolic syndrome prevention at all levels of medical education is required. Additionally, establishing communal training and therapy centers will be needed.

Multimodal behavioral intervention including education, medical nutrition therapy (diet, social, physio, and psycho), and coping strategies need attention to NCD prevention. A nutrition lens approach is required to remove the barriers and use opportunities for healthy lifestyle adoption. Whatever active screening is recommended for all individuals above 40 years, this scenario needs paradise shift to mid-of-life expectance (above 30 years and 20 years for those of their family who have a history of NCDs). Our people do not visit health institutes for early detection of NCD risks; so, community mobilization and motivation are suggested. Make sure to notice that people's habitual practices may have health implications to bring behavioral changes.

Ethiopia's current health care system placement of health facility structures and staffing is not established NCD clinics with a team of experts, except the specialized hospitals. So, it is strongly recommended to integrate healthy lifestyle education into health posts for primary prevention of NCD through health extension workers under the supervision of health officers or practitioner nurses, delivering NCD services at ART clinics, chronic care/referral clinics, and specialized clinics in the health center, general hospital and tertiary hospital respectively. In general, to be effective in healthy lifestyle adoption and chronic noncommunicable disease care, Ethiopia should take the social capital perspective into account and implement a primary prevention plan using healthcare workers.

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CHAPTER 4: UNDIAGNOSED DIABETES MELLITUS IN MIDDLE-AGE ADULTS OF WESTERN ETHIOPIA FOR 2019.

4.1. MAGNITUDE AND ASSOCIATED FACTORS OF UNDIAGNOSED DIABETES MELLITUS AMONG MIDDLE-AGE URBAN RESIDENTS OF WEST ETHIOPIA.

Redrafted from: Alemu Adeba, Dessalegn Tamiru, Tefera Belachew. Magnitude and Associated Factors of Undiagnosed Diabetes Mellitus among Middle-age Adults Urban Residents of West Ethiopia. Ethiop Med J, 2022, Vol 60, No, 1.Retrieved from https://www.emjema.org/index.php/EMJ/article/view/1916.*

ABSTRACT

Background: People are more likely to die due to biological impairment than chronological aging. Diabetes is a public health problem, whereby diagnosing proves challenging for health providers. However, the prevalence of undiagnosed diabetes in West Ethiopia goes unnoticed.

Aim: To investigate the magnitude and associated factors of undiagnosed diabetes mellitus among middle-aged adult urban populations in West Ethiopia.

Methods: A community-based cross-sectional study was conducted from 01 January 2019 to March 2019 on 266 undiagnosed middle-aged urban residents. Data was collected using questionnaires, anthropometric measurements, and biomarkers as per WHO steps. Fasting blood glucose ≥ 126mg/dl in the morning was taken as diabetes and FBS>100-125mg/dl, pre-diabetes (impaired FBS). SPSS version 24, multivariable logistic regression analysis was applied, and associated factors were considered statistically significant at 95%CI; p <0.05.

Results: The median interquartile range (±IQR) age of participants was 52.5 (±11.5) years. The overall magnitude of newly diagnosed raised fasting blood sugar was 7.14% among urban residents in west Ethiopia. Of this, 2.25% had diabetes and the remaining 4.89 % were pre-diabetes patients. On multivariable logistic analysis, having a high BMI and elevated blood

pressure were four (AOR: 4.87; 95% CI (1.01, 23.45) p=0.049)), and five (AOR: 5.22; 95% CI (1.67, 16.33) p=0.005)) times more associated with diabetes mellitus, respectively.

Conclusions: The results revealed undiagnosed diabetes was prevalent in West Ethiopia. Age-targeted community-based education and early detection are recommended to reduce its burden.

Keywords: *Undiagnosed diabetes, risks, Middle-aged, urban*

1. INTRODUCTION

Diabetes Mellitus (DM) is one of the four major non-communicable diseases (NCDs) causing a high morbidity and mortality, globally (IDF, 2018). It is a metabolic disorder of multiple aetiologies' characterized by chronic hyperglycemia induced by defects of insulin secretion and action or both (IDF, 2013).

Long-standing elevated blood glucose leads to micro and macrovascular complications(Chawla, A. *et al*., 2016) and becomes a serious health problem unless early screened (WHO, 2014). Complications from undiagnosed diabetes could lead to a significant decline in quality of life (Hajifathalian K, *et al*. 2016) and have a higher risk for premature death (WHO, 2016) unless prevented.

Globally, the magnitude of diabetes has been increasing among adults; According to International Diabetes Federation Atlas report, as of 2017, there are451 million people living with diabetes, with projections as tall as 693 million by 2045 (Karuranga S, *et al.,* 2018). Domestically, the prevalence of diabetes is higher in urban than rural areas (Huang Y, *et al*. 2017). In 2014, about 179.2 million people lived with undiagnosed DM worldwide with Africa having the highest percentage compared to other regions; about 62.3% of the people with the disease do not know the effects, and about 13.4 million were undiagnosed (Henriksen O, *et al.* 2011; Motala A, and Ramaiya K.2010; Roglic G. 2016).

Similarly in Ethiopia, the magnitude of diabetes the number of cases documented in 2000 (800,000), is rising, and it will hit an estimated 1.8 million by 2030 (Shimels T, *et al*., 2016; YemaneT. *et al*., 2007), in Gondar and Bahir Dar city were 2.3% diabetes and 10.2% individuals

lived with undiagnosed DM (Gelaw YA, *et al*, 2017; Arike EB, *et al*, 2019). Another study conducted in 2014 in Ethiopia showed, about 1,603,100 people (75.1% of the population) were undiagnosed for diabetes mellitus (IDF, 2013; Beagley J, *et al*.2014).

However, different factors not quite understood by the community contributed to the risk of diabetes development. Although undiagnosed diabetes is prevalent, it was not addressed well in West Ethiopia. So far, nothing has been done at the community level. Therefore, this study aimed to investigate the magnitude and associated factors of undiagnosed diabetes among middle-aged adult urban residents in West Ethiopia.

2. METHODS

2.1. STUDY DESIGN AND SETTING

A community-based cross-sectional study was conducted purposively in the hub of Western Ethiopian Town, Nekemte, which is located 328km from Addis Ababa. It is divided into 6 sub-cities administratively with an altitude ranging from 1960 to 2170 Meters above sea level. Its average annual rainfall and temperature ranges are 1854.9mm and 14^{oc} -26^{oc}, respectively. The total population of the city projection in 2007 was estimated to be, 148,613 in 2021, out of these 31,657 of them were adults aged 40 to 64 years (CSA, 2014).

2.2. STUDY PERIOD

The study was conducted on 266 people in middle-adulthoods from January 1st, 2019-1 March 2019.

2.3. SAMPLE SIZE

The sample size was calculated for each objective and the maximum sample was taking the prevalence of abdominal obesity the most common component of metabolic syndrome with 19.6% among healthy Ethiopian adults (GirmaB, *et al, 2011*). Hence with a margin of error of 5%, a confidence level of 95%, and 10% gnawing away, we had a minimum sample of 266 participants (Chapter 2).

2.4. SAMPLING TECHNIQUES

Randomly one community/Ganda or kebele was selected by lottery method from six kebeles to properly isolate and nullify any nuisance or confounding variables and one kebele not adjacent to the other was selected purposively. Each study participants were selected through simple random sampling techniques (Chapter 2).

2.5. ELIGIBILITY CRITERIA

Adults aged 40-65 years who were eligible to participate in the study were asked to undergo diagnosis and respond to questionnaires to be included in the study. While who were already on medication for NCDs, pregnant, lactating, serious mental conditions, bariatric surgery, and physical disabilities were excluded during recruitment based on self-report and pre-screening.

2.6. MEASUREMENTS

Fasting blood sugar (FBS) level was determined using samples taken early in the morning, with readings ≥126 mg/dL being classified as diabetes and 100-125mg/dl, pre-diabetes. In addition, other biomarkers like cholesterol l/evel and blood pressure other biomarkers like cholesterol level and blood pressure were also collected to assess common associated risk factors of diabetes.

2.7. DATA ANALYSIS

The data was analyzed using SPSS version 24(IBM corporation, NY, USA). Frequency, percentage, and descriptive summaries were used to explain the amount of study participants in the analysis. Descriptive statistics was used to summarize and describe various sample characteristics as well as the association between high blood glucose and other risk factors. The binary regression computed the crude OR and variables with p values less than 0.2 were entered into a multivariable logistic regression model to control potential confounding effects in the model. The strength of associations between independent and outcome variables was assessed using AOR with a 95% CI and p values <0.05 were considered statistically significant predictors of undiagnosed DM. Using Hosmer Limshaw, goodness-of-fit measures for Logistic Regression to check model fitness.

2.8. ETHICAL REVIEW AND CONFIDENTIALITY

Permission was sought from the Institutional Review Board (IRB), Institute of Health, Jimma University and households willing to participate in the study signed consent form (Chapter 2).

3. RESULTS

3.1. SOCIO-DEMOGRAPHIC AND LIFESTYLE CHARACTERISTICS

Out of two hundred sixty-six undiagnosed participants, 62.8% of them were females and more than half (54.89%) participants were living below poverty threshold (<1.25dollar/day). The average age of adults in our study was 52.5±11.5years, with participants aged 41-48 years accounting for 54.5%. Regarding lifestyle, majority (75.2%) of them live a sedentary life, and about 40.6% have fragmented sleep types, 24.8% had history of alcohol intake, 1.1% is current khat chewers and 2.3% smoke cigarette (Table 4:1.1).

Table 4:1.1 Socio-demographic and lifestyle characteristics of participants in west Ethiopia, 2019

		Raised fasting blood sugar	
		Yes (%), n=19	**No (%), n=247**
Sex	Female	12(4.51)	155(58.27)
	Male	7(2.63)	92(34.59)
Age in years	Range from 41-48 years	10(3.7)	135(50.75)
	Range from 49-56 years	5(1.8)	72(27.07)
	Range from 57-64years	4(1.5)	140(52.63)
Educational status	Illiterate	5(1.89)	81(30.45)
	Some school	10(3.78)	109(40.98)
	Diploma	3(1.13)	30(11.28)
	Degree and above	1(0.38)	27(10.15)
Marital status	Unmarried	1(0.38)	12(4.51)
	Married	15(5.64)	163(61.28)
	Widowed	2(0.75)	54(20.30)
	Divorced	1(0.38)	18(6.77)

Daily income	≥1.25USD	10(3.78)	110(41.35)
	<1.25UD	9(3.38)	137(51.50)
Physical activity	Low	18(6.77)	224(84.21)
	Moderate >120<150M'/W	0	13(4.89)
	Vigorous>15oM'/Wks	1(0.38)	10(3.78)
Smoking	Current	0	6(2.26)
	Former	2(0.75)	19(7.14)
	Never	17(6.39)	222(83.46)
Alcohol consumption	Current	3(1.13)	23(8.65)
	Former	4(1.5)	36(13.53)
	Never	12(4.51)	188(70.68)
Chewing of chat	Current	0	3(1.13)
	Former	2(0.75)	16(6.02)
	Never	17(6.39)	228(85.71)
Healthy diet	Low DD score	13(4.89)	168(63.16)
	Medium DD score	6(2.26)	70(26.32)
	High DD score	0	9(3.38)

DM: diabetic mellitus, DD: dietary diversity, USD: US dollar,

3.2. PREVALENCE OF UNDIAGNOSED DIABETES

The prevalence of pre-diabetes (impaired fasting blood glucose) and diabetes of the participants was 4.89 % and 2.25 %, respectively (Figure 4:1.1). Participants with elevated fasting blood sugar (FBS>126mg/dl) were linked to Wollega University Specialized Hospital chronic care unit for further diagnosis and follow up.

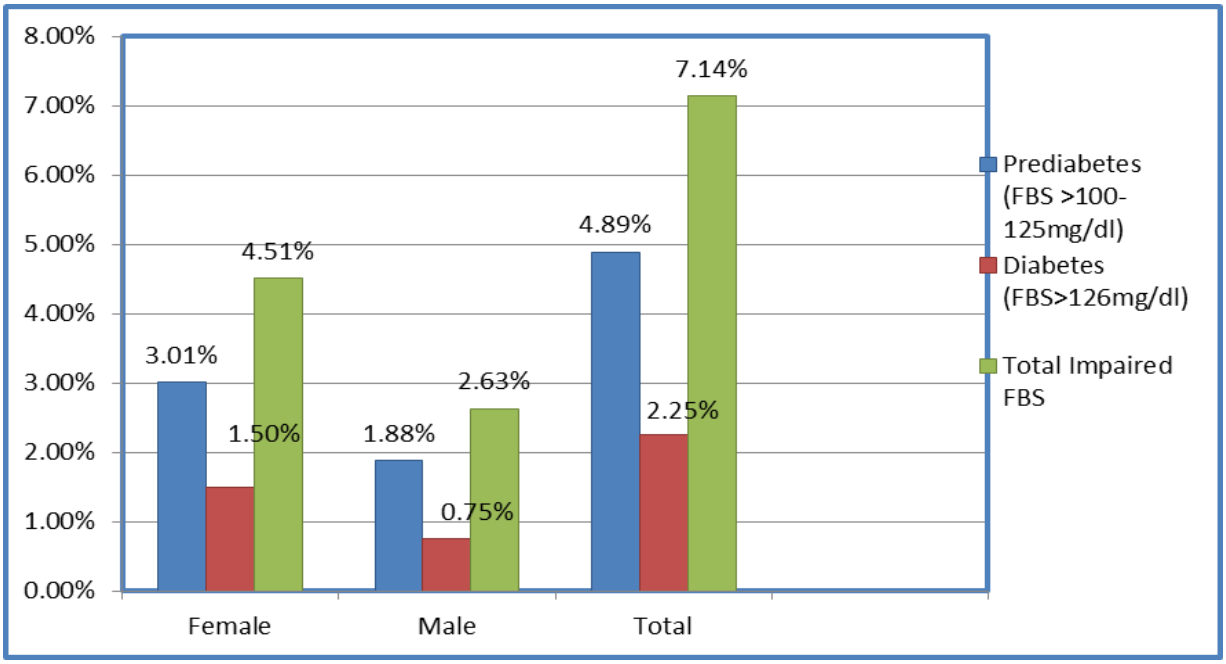

Figure 4:1.1 Description of fasting blood sugar by sex, west Ethiopia, 2019(n=266)

3.3. FACTORS ASSOCIATED WITH UNDIAGNOSED DIABETES

Of the total enrolled participants, 7.14 % were newly diagnosed, of which the actual diabetes accounts for 2.25%. The magnitude of diabetes is shown to significantly be associated with sleep disorders, sedentary lifestyle, increased: waist circumference, waist-to-height ratio, BMI, blood pressure, TG, and HDL on binary analysis. The multivariable logistic regression analysis showed that only increased BMI and high blood pressure were independently associated with diabetes (Table 4:1.2.).

The mean and SD of fasting blood glucose level was 99.7(29.60 mg/dl) with (95%CL: 96.12, 103.27; p<0.0001). The prevalence of diabetes significantly increased with high BMI (6%) when compared to participants with BMI <25 Kg/m2 (1.1%). Being BMI ≥ 25 kg/M2 increases the risk of developing of diabetes nearly five times (AOR: 4.87; 95% CI (1.01, 23.45), P=0.048)). Likewise, having had high waist circumference increased the risk of diabetes two times (AOR=1.61; 95%CI (1.14, 18.53), P =0.702)), and elevated blood pressure >130/85mmHg (AOR: 5.22; 95%CI (1.67, 16.33), P=0.005)) were associated with undiagnosed diabetes (Table 4:1.2).

Table 4:1.2. Multivariate analysis to identify factors associated with undiagnosed diabetes among urban residents of west Ethiopia, 2019 (n=266)

Variable	Categories	Undiagnosed Diabetes		COR (95% CI)	P	AOR (95% CI)	P
		Yes (%)	Absent (%)				
WC (Male/ Female)	≥ 90cm/80cm	17(6.39)	139(52.26)	6.61(3.54,9.67)	0.013	1.61(1.14,18.53)	0.702
	<90cm/80cm	2(0.75)	108(40.60)	1		1	
Waist to ht. ratio(M/F)	>0.49/0.50(M/F)	17(6.39)	148(55.64)	5.69(1.29,25.16)	0.022	1.99(1.19,20.88)	0.565
	<0.49/0.50(M/F)	2(0.75)	99(37.22%)	1		1	
BMI	≥25 kg/m2	16(6.02)	103(38.72)	7.46(2.04,12.47)	0.002	4.87(1.01,23.45)	0.049
	<25 kg/m2	3(1.13)	144(54.14)	1		1	
Elevated BP	≥135/85mmHg	10(3.78)	39(14.66)	5.93(2.07,9.74)	0.000	5.22(1.67,16.33)	0.005
	<135/85mmHg	9(3.38)	208(78.20)	1		1	
Raised Triglycerides	≥150mg/dl	10(3.78)	44(16.54)	5.13(1.97,13.36)	0.001	1.27(0.34,4.80)	0.722
	<150mg/dl	9(3.38)	203(76.32)	1		1	
HDL low in (mg/dl)	<40 ,50 for M/F	8(3.01)	43(16.17)	3.45(1.31,9.09)	0.012	0.38(0.11,1.31)	0.123
	>40 ,50 for M/F	11(4.14)	204(76.79)	1		1	

4. DISCUSSION

The current magnitude of raised blood sugar was 7.14%. The actual figure for diabetes was 2.25%. The crude data that includes pre-diabetes and diabetes was slightly higher than the estimated Ethiopian prevalence of DM by IDFA (5.2%) (Atlas D, 2014), studies conducted on some urban residents of Ethiopia like Gonder city (5.1%) (Atlas D, 2015), Dessie Town (6.8%), (Endis *et al.*, 2019), Mizan-Aman Town (6.5%) (Aynalem SB and Zeleke AJ, 2016), and in Hosana, south Ethiopia (5.7%) (Dereje N. *et al.*, 2016).

Contrary to the above comparison, the magnitude of undiagnosed diabetes is low when compared with a study conducted on 2013 on HIV/AIDS patients taking HAART in Ethiopia(8%) (Gose M *et al*., 2013), whereas, in Jimma Town 15% had Impaired Glucose Tolerances (YemaneT. *et al*, 2007). Likewise, the prevalence of undiagnosed DM was lower than in studies done in North India, Punjab (8.3%) (Rajiv Saran, *et al*, 2017), Pakistan (26.3%) (Qureshi H, *et al*,2018), Bangladeshi (9.7%) (Akter *et al*., 2014) and previous studies in African Countries (Balde NM. *et al*, 2007; Wilks R. *et al*, 1999; Abebe SM. *et al*, 2014; Nigatu T, 2012). This difference might

be due to variations in socio-demographic and lifestyle behavior factors of apparently healthy communities.

Different scholars agree that a sleep disorder is highly associated with diabetes. For instance, diabetic patients often have a high prevalence of obstructive sleep apnea (OSA) (Berne C, *et al*. 2001). Clinical studies have shown an increase in serum glucose in patients with OSA, independent of obesity (Lam KS *et al*, 2002; Punjabi NM. *et al*, 2002). In this study, we observed an independent association (P=0.023) between high fasting blood glucose and sleep apnea.

5. CONCLUSIONS

The magnitude of undiagnosed diabetes mellitus among adult urban residents in western Ethiopia was found to be high. On multivariate analysis, it was shown that having a high body mass index, sleep disorder, and elevated blood pressure were significantly associated with diabetes mellitus. Therefore, age-targeted community-based education on early detection and prevention of diabetes, as well as its complications are significant in saving adult life. General, diabetes surveillance needs to be strengthened to reduce the prevalence of UDM at the national level.

6. IMPLICATIONS

The implications behind this study comprise providing community healthcare workers with detailed knowledge to deliver health promotion and disease prevention strategies, as well as enabling the early identification of adults at risk of diabetes mellitus, and establishing a community screening system in the future. It also provides researchers with knowledge to help them identify research gaps and direct future research progress.

4.2. WHICH AGE GROUP IS MORE RISKY FOR DIABETES AMONG MIDDLE-ADULTHOOD URBAN POPULATION IN WEST ETHIOPIA?

*Redrafted from: Alemu Adeba, Dessalegn Tamiru, Tefera Belachew.Which age group is peak for onset of diabetes among mid-adulthood urban population in West Ethiopia? **African** J. Diabetes Med.Vol.29 No 6.2021. ISSN: 2053-4787. Retrieved:// www.africanjournalofdiabetesmedicine.com*

ABSTRACT

Background: Diabetes mellitus is high in middle and older age groups. Evidence shows that 45 years is the age for the onset of diabetes. However, which age group is the peak season for the onset of diabetes among middle-aged people is not answered, especially in Ethiopia.

Objective: To investigate the peak risk of the onset of diabetes among middle-aged urban populations.

Methods: The population-based cross-sectional method was applied to 266 adults stratified with age groups 41-48, 49-56, and 57-64 years. Selected communes were selected one randomly and the other one purposively by matching with the first commune. Representative samples were equally selected from the two communes (Chapter 2).

Results: Potential risky age for diabetes onset was evaluated between 41-48 years (early-onset) and peak phase for onset of diabetes, 49-56 years (average-onset), and 57-64 (late-onset) of adulthood. On logistic regression, early age of middle adulthood (41-48) was associated significantly with the onset of diabetes (OR: 0.74; 95%CI; 0.55, 0.93, P<0.01) compared to other middle and later adulthood.

Conclusion: The age group of 41-48 years was the peak phase for the onset of diabetes for adults in West Ethiopia. Therefore, educating the community on healthy lifestyles and early detection habits is crucial to prevent diabetes and its complications.

Keywords: Diabetes; risky age group; urban; west Ethiopia

1. INTRODUCTION

Diabetes is a degenerative chronic illness that affects adulthood and older, induced by the potential risk of hyperglycemia. Raised glucose in the blood, was the main effect of unrestrained diabetes and through duration, it leads to serious damage to many of the organ systems, especially the nerves and blood vessels(WHO, 2006).

Shreds of evidence showed, that if diabetes is not early treated, it can damage the heart, blood vessels, eyes, kidneys, and nerves (IDF, 2019). The risk of heart attacks and strokes has 50%-75% increased among adults with diabetes (CDC.2008, Angelantonio *et al.* 2010). Diabetes retinopathy is an important cause of 2.6% of global blindness and arises as a result of long-term accumulated damage to the small blood vessels in the retina (Price H *et al*.2013). Studies postulated that diabetes is among the leading causes of kidney failure (Bethesda. 2014).

Fasting glucose intolerance or pre-diabetes is a grave health condition where blood sugar levels are higher than normal, but not high enough yet to be diagnosed as type 2 diabetes until FBS>126mg/dl (CDC,2008). Approximately 88 million (33.33%) American adults have pre-diabetes. Of those, more than 84% don't know they have it. Pre-diabetes puts you at increased risk of developing type 2 diabetes, heart disease, and stroke(CDC,2008).

Globally, the prevalence of type 2 diabetes has been increasing among adults; 451 million people living with diabetes as of the International Diabetes Federation Atlas report in 2017 and projected to tall to 693 million by 2045(IDF,2018). ased on inhabitation the prevalence of diabetes is higher in urban than rural areas(Huang Y, *et al*,2015).

According to World Health Organization 2000 projection by 2030, the magnitude of DM is expected to be 1.8 million among Ethiopian adults (Shimelis T, *et al*.2016, Yemane T, *et al*. 2007). Studies from north Ethiopia, figure out about 2.3% of Gondar city and 10.2% of Bahir Dar City (Bantie GM, *et al*.2019) individuals lived with undiagnosed DM(Gelaw YA, *et al.* 2017, Bantie GM. *et al. 2019*). Likewise, a study conducted in 2014 in Ethiopia showed, about 1,603,100 (75.1%) of the population were undiagnosed for diabetes mellitus (Motala AA, *et al*. 2014, IDF. 2018). In 2015, around 1.5 million new cases of diabetes were recorded among adults according to the CDC's 2017 National Diabetes Statistics Report(Kristeen Cherney, 2018) and

adults aged 45 to 64 were the most diagnosed age group for diabetes; therefore, it is important to know which age group contributes towards its onset (Kristeen Cherney, 2018).

However, which age group [41-64 years] is most likely to incidence of diabetes is still not answered. Thus, this study aimed to investigate which age group is most strongly associated with the onset of diabetes among middle-aged [41-64 years] urban residents in West Ethiopia.

2. METHODS

2.1. STUDY AREA AND PERIOD

The current study was performed purposively on urban residents in towns of Western Ethiopia called Nekemte Town from February 1-15, 2019, which is 328Km far from Addis Ababa(Chapter 2).

2.2. RESEARCH DESIGN

A community-based cross-sectional study design was applied.

2.3. POPULATIONS

Adults 40-65 years who lived more than six months in Nekemte city were the target populations, all adults in two selected Gandas were our study populations and the selected adults from the two kebeles/Gandas were the samples included in this study. Individuals on treatment for diabetes; pregnancy, lactating; psychiatric conditions; ill; use of weight-impacting medication, and physically disabled were excluded.

2.4. SAMPLE AND SAMPLING TECHNIQUES

The sample size was calculated by taking the most common prevalence of the dependent variable among healthy Ethiopian adults, component of metabolic syndrome is abdominal obesity (19.6%) in Ethiopia(GirmaB, *et al*.2011), a 5% level of significance and a 5% margin of error. Finally, 266 samples were researched (Chapter 2 & 3:1).

2.5. DATA PROCESSING AND ANALYSIS

The data were first checked for completeness and consistency and cleaned for outliers and missing values. Epi-Data version 3.1.2 was used for data entry and exported to SPSS version 24 for analysis. The results were presented using frequencies in tables and figures. To analyze the biomarker, finger plucks blood specimens were collected as standard (Chapter 4:1).

2.6. ETHICAL CONSIDERATIONS

The research protocol was approved by Jimma University; Institute of Health; Institutional Review Board (IRB; Reference No: IHRPGD/596/2019) (Chapters 2 and 3).

3. RESULTS

3.1. PARTICIPANT'S CHARACTERISTICS

Of the total participants 19 (7.14%) had elevated blood glucose and 63.16% of them were females. Out of undiagnosed samples, 93.56% of respondents had low physical activity, while the rest accounted for 6.77%. With sex stratification, 4.51% of females were diabetic. Regarding alcohol consumption, 24.81% of respondents had a history of harmful alcohol drinking and 11.86% of them were currently drinking alcohol (Table 4:2.1).

Table4:2.1 Characteristics of participants by fasting blood sugar , west Ethiopia, 2019(n=266)

		Fasting Blood Sugar (%)	
Variables		Raised >100mg/dl	low<100mg/dl
Physical activity	Low	18(6.77)	224(91.73)
	Vigorous	1(0.38)	10(3.76)
	Moderate	0	13(4.89)
Smoking	Yes(quit , current)	2(0.75)	25(9.40)
	Never	17(6.39)	222(83.46)
Alcohol	Yes(quit , current)	7((2.63)	59(22.18)
	Never	12(4.51)	188(70.68)
Chet chewing	Yes(quit , current)	2((0.75)	19
	Never	17(6.39)	228
Sex	Female	12((4.51)	155(58.27)
	Male	7(2.63)	92(34.59)

3.2. PREVALENCE OF IMPAIRED FASTING GLUCOSE

The prevalence of pre-diabetes (impaired fasting blood glucose) was 4.89% and 2.25% of the participants were diabetic patients. The highest proportions of undiagnosed diabetes (4.51%)

were found among females. Six participants with elevated fasting blood glucose were referred to a chronic care center (Wollega University Specialized Hospital) for follow-up (Table 4:2.2).

Table 4:2.2. The prevalence of impaired fasting blood sugar among adults in Nekemte, 2019.

		Impaired FBS (%)	Diabetes (%)
Variables		FBS >100-125mg/dl	FBS>126mg/dl
Sex	Female	8(3.01)	4(1.5)
	Male	5(1.88)	2(0.75)
Total		4.89	2.25

3.3. Association of sex and age groups with diabetes

From the three age groups of the population, age between 41-48 years were highly (3.78%) affected. Meaning the age of 40 was associated with the onset of both pre-diabetes and diabetes. From healthier adults did not now have diabetes but were diagnosed during the study, the prevalence of hyperglycemia peaked at the age of 41-48 years group. The magnitude declined between 57 and 64 years, but in general middle-aged adulthood was the peak season for the onset of diabetes. On logistic regression, newly diagnosed populations with raised blood sugar age of 41-48 group were associated with significant risk factors for of onset of diabetes (OR:0.74; [95%CI: (0.55, 0.93), p <0.01]) and being female (AOR:1.25; [95%CI: (1.08, 1.42), p <0.010]) more likely associated to raised FBS (Table 4:2.3).

Table4:2.3 Multivariable logistic regression analyses of Raised FBS, urban, west Ethiopia.

		Raised FBS (%)			
		Yes	No	95%CI	
Variable		>100mg/d	<100mg/dl		P-value
Age	41-48	10(3.78)	135(50.75)	0.74 (0.55,0.93)	<0.001
group	49-56	5(1.88)	72(27.07)	0.69 (0.39,0.99)	0.02
	57-64	4(1.51)	40(15.04)	1	
Gender	Female			1.25(1.08,1.42)	0.001
	Male			1	

4. DISCUSSION

The finding of this study confirmed that the prevalence of undiagnosed diabetes including pre-diabetes was 7.14%; of this, 2.25% came with FBS>126mg/dl. This number is relatively smaller

than results reported in different urban populations of Ethiopia like 6.8% in Dessie Town(Endris T. *et al*., 2019) and 6.5% in Mizan-Aman Town(Aynalem SB and Zeleke AJ. 2018).

From general diabetes risks, age is a common risk factor for it (Byrd-Holt DD, *et al*. 2010). Aging speeds up during middle adulthood with a decline in vision, hearing, and immune-system functioning, and the end of menopause (Lumen Bandala, 2019). Similar to the study done by (Maurya, G.K. *et al.*2021), this study also implies that middle-aged adulthood is a high-risk factor for type 2 diabetes. Also, studies argue age 45 and above are the onset of type2 DM (Maurya, G.K. *et al.*2021), usually appears after the age of forty-five and testing should begin at age 45 years (Diabetes Care, 2018), but the current study recommends ages above 45 were candidates for complications like diabetes retinopathy. The current study disproved that the age of 45 is not the time for the onset of diabetes but it is a peak season for complications. So, mid-off life expectancy is recommended for screening diabetes mellitus. This is a novel and relevant for the East Africa region of the world. This should change diabetes screening programs in the policy setting in low-income countries like Ethiopia. High blood sugar can cause damage to many parts of your body, including your eyes, heart, feet, nerves, and kidneys, high blood pressure, and hardening of the arteries. Diabetes is a chronic disease, and it could affect both health and quality of life (QOL).

5. CONCLUSIONS AND IMPLICATIONS

We verified that middle adulthood age is a transition and dangerous age. The peak age for the onset of diabetes is the age group between 40-48 years. It disproved that the age of 45 years is not a time for the occurrence of diabetes. This indicates a revision policy for screening needed before complications. In conclusion, since peak age for the onset of diabetes is 40-48 groups for middle-aged adults.

This finding implies that it is suggested better to start screening following nearly mid of life expectancy in Ethiopia, since the age of 50 and above comes with end-line diseases like kidney failure, vision impairments, in general macro and microvascular diseases. This should change diabetes screening programs in the policy setting in low-income countries like Ethiopia.

CHAPTER 5: EFFECT OF HEALTHY LIFESTYLE EDUCATIONAL INTERVENTIONS IN MIDDLE-AGED ADULTS OF NEKEMTE TOWN, ETHIOPIA: A PRE-POST-TEST QUASI-EXPERIMENTAL STUDY.

5.1. THEORY-BASED LIFESTYLE EDUCATIONAL INTERVENTION THROUGH INTENSIVE COMMUNITY LEADERS' AFFECTS HEALTHY LIFESTYLES ADOPTION OF MIDDLE-AGED NEKEMTE POPULATIONS: A QUASI-EXPERIMENTAL CONTROL STUDY.

Redrafted from: Alemu Adeba, Dessalegn Tamiru, Tefera Belachew. Theory-based lifestyle educational intervention through intensive community leaders' affects healthy lifestyles adoption of middle-aged Nekemte populations: A quasi-experimental control study. MEDICINE 2023,* http://dx.doi.org/10.1097/ MD.0000000000031414.

ABSTRACT

Background: The intensive participation of community leaders in teamwork is essential for healthy lifestyle adoption and lifestyle disease prevention. Adult-centered lifestyle education intervention is a simple method and requires less power. However, the effect of community leaders' engagement in education on the effectiveness of intervention, adults' team performance, and satisfaction was not noticed in West Ethiopia.

Objectives: This study aimed to evaluate the effect of theory-based education intervention through intensive community leaders on the intervention mapping approach to healthy lifestyle adoption of middle-aged Nekemte dwellers.

Methods: A pre-test-post-assessment non-equivalent control quasi-experimental study was conducted from January to July 2019 and post-data were collected in August 2019. After 3 months of intensive lifestyle education for the intervention group, weekly 1 session of 30 to 50 minutes was given for the other 3 months and the team was led by community leaders. After under close monitoring rest of three months, post-data were collected in August 2019.

Results: Out of 266 healthy, 253 were available for analysis. With SPSS version 24, data analyzed for descriptive statistics, difference-in-differences the mean difference, independent t-test, and the correlation between variables were analyzed and significance was considered at P value < 0.001): self-efficacy (P < 0.001), affects related behavior (P < 0.001), interpersonal influences (P < 0.001), perceived benefits (P = 0.001), barriers (P = 0.003) and commitment to action of a plan (P < 0.001) were significantly changed at the end line. The role of the team leader's effort was 92.19% for successful competition of the intervention and the average scaling rate of team effectiveness was 73.19% and significantly associated with effectiveness (R = 0.82, P < 0.01), leader effort (R = 0.73, P < 0.01), and satisfaction (R = 0.84, P < 0.01). A community-based team leader has a positive correlation with the effectiveness and implementation of lifestyle education intervention. The study revealed that theory-based educational intervention through intensive community leaders is effective in participants' retention, healthy lifestyle adoption, and anthropometric measure reduction, improvement of adults' team performance & satisfaction, and rapid implementation of intervention at the community level.

Conclusion: Hereby theory-based educational intervention through intensive community leaders is a prominent educational tool to implement lifestyle education, adopt healthy lifestyles, and prevent chronic diseases. The findings imply the need for targeting the middle-aged in designing healthy lifestyle education interventions.

Keywords: community leaders, Lifestyle education, HPM, intervention mapping, middle-aged adults.

1. INTRODUCTION

Nowadays, lifestyle diseases are emerging public health problems in developed and developing countries (Karwa DS, *et al*, 2012). For this case, the World Health Organization recommendation encourages all policy-makers should develop cost-effective approaches to prevent non-communicable diseases (de Silva-Sanigorski A, *et al*. 2011).

The team leadership model creates an environment in which members are accountable not just to the coach, but to the team as a whole (Dinarvand R, *et al*.2017, Sarmiento OL, *et al*.2012). A team leader is a person who provides guidance, instruction, direction, and leadership to a group of teams or individuals to achieve a key result or group of aligned results (Glanz K . *et al*.2015). The team leader has the most direct and significant impact on the experience of the people on the

team (Northouse PG, 2021). Work team research has seen tremendous advancements in the past few decades, with the majority of work being conducted in the context of multilevel designs and analyses (Northouse PG, 2016, Abraham Z. 1977). This multilevel approach views teams in context and composed of different members, enabling the modeling of upward, downward, and team-level relations (Klynn B. 2021, Domingo MA, et al. 2019). Moreover, constructs in a team's research are typically categorized according to their position in a research model (Park S. et al.2018, Northouse PG, 2016).

Effective teamwork is an essential factor for organizational success, frequently cited in the grey literature (Kozlowski SWJ and Chao GT. 2018, Mathieu J. and Chen G. 2011, Rothman NB. *et al.*2017). Recent pieces of evidence have suggested that lifestyle interventions can be conducted in diverse community settings (Leeds: NHS Leadership Academy, 2013). Effective team performance derives from several fundamental characteristics (Snelling, I., *et al*, 2013, Walmsley J. and Miller K. 2008). A central responsibility of team leaders is to raise the collective efficacy of the team (Snelling, I., *et al*, 2013).

Community leaders believe that leadership is a multidimensional and inclusive process (Jooste, K. *et al*. 2016). Effective community leadership contributes to youth engagement and health promotion (Williams R *et al*.2013, Winett RA *et al*.1999). In any direction of thinking, significant impact is achieved only when programming targets local community members (UNDP, 2006). Group-based healthy lifestyle intervention delivered in rural and underserved communities is acceptable; improves the retention of participants and the effectiveness of the program (Maher, C.A *et al.* 2021). To evaluate the effectiveness and sustainability of healthy lifestyle interventions, we need to understand which specific components of the intervention determine behavior change(Michie S *et al.* 2013), and how scopes of interventions are implemented in real-world settings (Durlak JA, and Dupre EP. 2008).

A community-based lifestyle intervention was recommended (Brownson, R. C.*et al*. 2012). However, for these interventions to be effective, they must be rigorously designed, incorporating practical and theoretical elements (Viswanath, K.*et al* .2008). Intervention Mapping is a planning approach that is based on using theory and evidence as foundations for taking an ecological approach to assessing and intervening in health problems and engendering community

participation. The keywords in intervention mapping are planning, research, and theory (Parcel, G. S. *et al* .2016).

Nevertheless, the world has different cultural demographics and individuals (Ben-Nakhi A., *et al*. 2007, Trovato GM . 2012); in this decade, different studies have been conducted to evaluate lifestyle modification programs' effect in adult populations (Kerrison G, *et al*.2017, Lobelo F, *et al.* 2017, Dionne IJ, *et al.* 2015, Webb VL, and Wadden TA. 2017). Among several theories and models that support the practice of health promotion and disease prevention, the Theory of Planned Behavior (TPB) is one of the behavior change theories that can be highly helpful in the design and evaluation of comprehensive educational programs (Hamayeli, M. H., Mirmiranl, P., & Alaiin, F. A. F. 2009).

According to this theory, an individual's intention can be predicted by three determinants, namely attitude towards the behavior, beliefs about the motivation to comply with other expectations (subjective norms), and beliefs about the perceived level of control over factors that can either facilitate or hinder behavior performance (perceived behavioural control) (Ajzen, I. 1991). Pender's HPM model is derived from the social cognitive theory with nine potential constructs; this is a theoretical framework for evaluating the determinant that contributes to the promotion of healthy lifestyle behaviors and individuals' commitment to healthy behaviors (Pender NJ, 2011, Pender *et al.*, 2015).

Intervention mapping provides guidelines and tools to ensure health promotion program is based on empirical evidence and sound theories. Intervention Mapping is also used for the planning and development of implementation strategies for program adoption, implementation, and maintenance (Parcel, G. S *et al* .2016). Intervention Mapping is an approach used for developing effective behavior change interventions (Bartholomew *et al*., 2016).

Having leadership skills was a key factor in delivering effective interventions (Geniembo B *et al.* 1993). Healthy lifestyle adoption is an exact tool to prevent metabolic syndrome and its complications (Fraser H, *et al.* 2017, Gao Y, *et al*. 2011, Tomar R S, *et al*. 2007, WHO.2014). Nevertheless, team leaders could lead to higher levels of healthy lifestyle adoption, team leader effort, and adult satisfaction, the role of community leaders in the team cannot be evaluated. However, leader's effect on the implementation of healthy lifestyle educational intervention

targeting middle age to prevent NCDs was not addressed well in Ethiopia. Therefore, this study aimed to evaluate the effect of theory-based education intervention through intensive community leaders on the intervention mapping approach to healthy lifestyle adoption of middle-aged adult dwellers of Nekemte Town.

2. METHODS

2.1. STUDY SETTING

The study was conducted in Nekemte Town which is hub of western Ethiopian towns, located in western Oromia, 328Km from Addis Ababa, Ethiopia (Chapter 2).

2.2. STUDY DESIGN AND PERIOD

A pre-test-post-test non-equivalent control quasi-experimental study was conducted from January to July 30, 2019, to evaluate the effectiveness of the community leaders-based educational intervention on the intervention mapping approach to the implementation of healthy lifestyle adoption in the study population.

2.3. TARGET PARTICIPANTS

Study population were selected randomly from the all middle aged [41-64 years] adults population in Nekemte Town. Eligible participants were included and otherwise (see chapter 2 and Chapter 5:1).

2.4. SAMPLE SIZE DETERMINATION AND PROCEDURE

We determined the sample size for each dependent variable and the highest sample size for the objective of the study was taken. From six kebeles (small sub-city or communes) of Nekemte Town, two communes that had no adjacent natural border but were homogeneous in terms of socioeconomic and geography were selected. Accordingly, one commune was randomly selected using the lottery method, and the other was purposively allocated with a buffer zone in between to reduce contamination. The participants' flow diagram was presented as follows (see Chapter 2 and Fig. 2:2).

2.5. STUDY GROUPS

2.5.1. INTERVENTION GROUP

The study participants in the intervention group engaged in an intensive lifestyle modification program for 6 months through community-based leaders. The intervention included behavioral change such as healthy lifestyle adoption, teamwork, and association of metabolic syndrome with health-related quality of life.

2.5.2. CONTROL GROUP

Participants in the control group did not receive any additional information other than routine health information and mass media communication.

2.6. LEADERSHIP STRATEGIES DURING INTERVENTIONS

The effectiveness of the program was based on the strengthening of the leaders. This work might explore the interplay between leadership, and implementation outcomes of the healthy lifestyle education intervention. To accomplish the tasks, the intervention groups were grouped into manageable teams. For two groups one leader was assigned, total four group leaders and one general leader lead the overall activities during the intervention period. At the end of the week, the general leader collected the activities phones among the team from the four leaders and recorded the event (see Chapter 2 and Figure 2:4).

2.7. MULTI-SETTING INTERVENTION

Face-to-face education & counseling, community mobilization through community leaders, written materials, Nutrition education, and the promotion of health policies to facilitate healthy lifestyles among the intervention group were strategies used in the community setting (chapter 2).

2.8. ANALYSIS

Data were checked, cleaned, coded, and entered into Epidata 3.1 version and then it was exported to SPSS (version 24, SPSS Inc., Chicago, IL, USA) for further analysis. Conceptual analyses were conducted with different models to evaluate the effectiveness. The baseline

difference in findings from statistics value between the two groups and the mean difference in implementation of healthy lifestyle educational intervention between the intervention and control groups was examined. The correlation between variables was analyzed considering team leadership as the independent variable.

2.9. ETHICS REVIEW

The study was conducted following the Declaration of Helsinki on medical research involving Human Subjects (WHO,2001) (Chapter 2).

3. RESULTS

Figure 2:1, shows participant flow through the healthy lifestyle educational intervention. A total of 266 were recruited at baseline. During the six-month follow-up, only 4.88% of participants did not complete the study. Of this high dropouts were seen among the control group as compared to intervention. A total of 133 people accepted the healthy lifestyle education and received the intervention.

3.1. EFFECT OF THEORY-BASED LIFESTYLE EDUCATION

3.1.1. BEHAVIOURAL LIFESTYLE CHANGES

The healthy lifestyle education showed behavioral change after six months of intervention. The number of current smokers in the intervention group reduced from 3.8% to 2.3%. Similarly, current alcohol drinkers withdrew by 9.4% from 11.3% and chat chewers declined from 1.5% to 0.8%. Besides, the four major modifiable lifestyle factors, the prevalence of inadequate sleeping patterns decreased by 19.5% among the intervention group during the post-test of the study. By using 12 food groups, a poor/healthy dietary score was calculated. Accordingly, healthy lifestyle practices because of intervention showed an increment of 25.2% among the intervention group as compared to the control group (Table 5:1.1).

Table 5:1.1. Behavioural change differences groups through team leadership, Nekemte, 2019.

		Intervention Group (%)			Control group (%)			Effect size
Variable	**Category**	**Pre-test**	**Endline**	**D/ce**	**Baseline**	**Post-test**	**D/ce**	
Diet	Unhealthy	127(95.5)	90(70.3)	-25.2	130(97.7)	114(91.2)	-6.5	-18.7
	Healthy	6(4.5)	38(29.7)	25.2	3(2.3)	11(8.8)	6.5	18.7
Tobacco use	Current	5(3.8)	1(0.8)	-3	1(0.8)	1(0.8)	0	-3
	Quit	12(9)	9(6.8)	-2.2	9(6.8)	6(4.8	-2	-0.2
Physical activity	Low	120(90.2	66(51.6)	-38.6	122(91.7)	103(82.4)	-9.3	-29.3
	High	8(9.8)	62(48.4)	38.6	11(8.3)	22(9.6)	1.3	37.3
risk alcohol	Currently	15(11.3)	11(8.3)	-3	11(8.3)	9(7.2)	-1.1	-1.9
	Quit	28(21.1)	12(9)	-12.1	12(9)	11(8.8)	-0.2	-11.9
Khat/ chat	Currently	2(1.5)	1(0.8)	-0.7	1(0.8)	0	-0.8	-0.1
	Quit	13(9.8)	5(3.8)	-6	5(3.8)	6(4)	0.2	-5.8
Sleep	<6hrs/day	81(60.9)	53(41.4)	-19.5	119(89.5)	102(81.6	-7.9	-11.6
	6/9hrs/day	52(39.1)	75(58.6)	19.5	14(10.5)	23(18.4)	7.9	11.6

D/ce= mean differene, Effect size= difference of difference

3.1.2. CHANGE IN ANTHROPOMETRIC MESUARES OF ADULTS

After theory-grounded lifestyle educational intervention and during months after the intervention follow-up, the mean of behavioral intention in health care empowerment for middle-aged adults was calculated. All participants undertook weight, height, waist, and hip circumferences. Post-intervention data indicated the anthropometric measure of the waist and hip circumferences in the intervention group showed a significant decline than the control group. Six months after the initiation of the team-based healthy lifestyle educational intervention, the intervention group accomplished greater BMI loss of mean and SD (-1.78±0.54) than the control group. The

average mean of hip circumference showed a significant reduction (-2.26±2.43) among interventions (Table 5:1.2).

According to the findings of this dissertation, the baseline mean BMI measures among the groups were comparable. Participants in the intervention group achieved a reduction of BMI, WC, and HC targets in the lifestyle changes over time were significantly different between groups (p<0.001). After lifestyle education, there was a statistically significant difference in mean BMI among the two groups (T=14.17, P<0.001) (Table 5:1.2). Similarly, the baseline WC status was comparable, however, there was a statistically significant difference in the end-line metabolic syndrome among the two groups (T= 12.29, P<0.001) (Table 5:1.2).

Table5:1.2. Appraisal of the mean and Standerd diviation of BMI, WC and HC measurement tests of between-subject effects of intervention and control group, Nekemte, (n=266), 2019.

Variables		Intervention (Mean±SD)	Control (Mean±SD)	T-Test	P
BMI	Baseline	23.06±3.59	22.65±3.76	2.36	0.37
	Endline	21.28±2.96	22.72±3.79	14.17	<0.001
	Change	-1.78±0.54	0.07±0.03		
WC	Baseline	85.59±7.77	85.19±8.96	0.03	0.631
	Endline	84.19±6.67	85.60±8.92	12.29	<0.001
	Change	-1.4±1.1	0.41±0.04		
HC	Baseline	93.32±8.73	93.66±9.38	0.03	0.562
	Endline	91.06±11.16	93.93±9.40	11.26	<0.001
	Change	-2.26±2.43	0.27±0.02		

***P<0.001, *P<0.01, P<0.05; SD: Standard deviation; df=252; Change =Mean differences at 95% CI; CI= Confidence interval

3.2.4. MEAN AND STANDARD DEVIATION OF CONSTRUCTS OF THE TPB

The results of the GEE model showed that the most and the least difference between the intervention and control groups belonged to perceived behavioral control (10.39). There was a significant difference among all direct TPB constructs six months after the intervention. The highest and lowest scores among indirect TPB constructs before the intervention were attitude toward behavior (58.07±16.15) and perceived behavioral control (55.56±16.52), respectively. Results also showed that the most difference between the intervention and control groups was for subjective norms (8.93) and the least amount of difference was for perceived behavioral control (6.46) (Table 5:1.3).

Table 5:1.3. Mean and standard deviation of direct constructs of the theory of planned behavior after intervention, Nekemte, 2019

Variables	Group, mean±SD		Group*Time interaction effects in the GEE models[a]		
	Intervention	Control	ES	95%CI	*P*
Attitude toward the behaviour					
BLT	58.07±16.15	72.95±16.23	7.12	5.51, 8.72	<0.001
ELT	70.18±11.24	67.24±13.25			
Change	-12.11±4.91	5.71±2.98			
P	<0.001	<0.001			
Subjective norm					
BLT	58.36±16.41	71.73±23.15	8.93	6.57, 11.28	<0.001
ELT	70.09±11.35	64.98±20.95			
Change	-11.73±5.06	6.87±17.85			
P	<0.001	<0.001			
Perceived behavioral control					
BLT	55.56±16.52	73.15±21.50	6.46	4.02, 8.91	<0.001
ELT	65.95±12.81	68.75±18.30			
Change	-10.39±3.71	4.40±3.20			
P	<0.001	<0.001			

SD=Standard deviation, BLT= Baseline Test, ELT=End line Test, GEE=Generalized estimated equastions; *p < 0.05; ** p < 0.01; ***p < 0.001.

3.2.5. INTERACTION OF INTERVENTION WITH TIME PERIOD

This finding was happening simultaneously with the Generated estimation equations models that showed significant interaction effects between time and groups. The results of this study showed that among the middle-aged adults in the intervention group compared with the control group, preceding behaviors (P< 0.001), self-efficacy (P <0.001), Affects behavior (p<0.001), interpersonal influences (P <0.001), perceived benefits (P =0.001), and barriers (P = 0.003) and commitment to action of a plan (P <0.001) were significantly changed across time during baseline through follow-up to end line (Table 5:1.4).

Table 5:1.4. Interaction of intervention with time period for each health promotion models (HPM's) constructs, Nekemte, 2019

HPM's constructs*	Estimated parameter	SE	95% CI	P-value
Preceding behaviours	0·74	0·18	0·31, 0·98	0·001
Perceived self-efficacy	0·54	0·13	0·27, 0·71	0·001
Affects related behaviour	0·51	0·17	0·29, 0·76	0·001
Perceived benefits	0.78	0·21	0·19, 0·75	0·001
Perceived barriers	0·59	0·11	0·22, 0·91	0·003
Commitment to action	0·62	0·12	0·30, 0·86	0·001
Interpersonal influences	0·74	0·23	0·27, 0·91	0·001
Situational influences	0·54	0·33	0·17, 0·47	0·09
Behaviour outcomes	0·56	0·13	0·37, 0·85	0·001

*Adjusted for number of adults and other socio-demographic, SE-standard error

3.3. EFFECT OF COMMUNITY-BASED TEAM LEADERSHIP ON ADULT'S PERCEPTIONS AND PERFORMANCE

An effective leader should motivate and empower others to be their best. In addition to the above results to assess the role of team leaders in the implementation of healthy lifestyle educational intervention; the participants were asked to think team leadership effect in adopting a healthy lifestyle. The perception of participants on team leaders regarding improving your healthy lifestyle practices (yes= score 1, or score 0)? Team members were asked to give their feelings of effectiveness, extra efforts and satisfaction on leadership outcomes measure. From 128 participants who completed the lifestyle educational intervention, 105(82.03%) were satisfied with the program. In comparison among sexes, males were more satisfied with healthy lifestyle educational interventions compared to females. Regarding the role of team leaders, 118(92.19%) had testimony that the initiation to morally complete the intervention was the effort of the team leaders. The average scaling rate of team effectiveness is 73.19% (Table 5:1.5).

Table 5:1.5.Effect of team leadership on Change in adult's perceptions and performance, 2019

Variables	**Categories**	**Yes (%)**	**No (%)**
Participants satisfied with theory-based lifestyle educational intervention.	Female(n=90)	73(81.11)	17(18.89)
	Male(38)	32(84.21)	6(15.79)
It was believed healthy lifestyle practices performed by team leadership.	Female	83(92.22)	7(7.78)
	Male	35(92.11)	3(7.89)
Intervention completed by initiation of leaders.	Female	87(96.67)	3(3.33)
	Male	31(81.58)	7(18.42)

How effective would you rate your team? (Scale, 0 to 100 %?)	Below average	Medium	High
	47.53%	78.25%	93.79%
Notes: N=128, Female=90, male=38			

Table 5.1.6 shows the mean lifestyle care knowledge, attitude toward lifestyle care, and level of self-efficacy in the provision of lifestyle care by the participants. The mean lifestyle care knowledge scores of middle-aged adults increased significantly from 19.49 (95% Cl: 18.71–20.27) at baseline to 22.76 (95% Cl: 23.77–21.75) post-intervention. Likely, the mean lifestyle care knowledge scores of middle-aged adults increased significantly from 4.03 (0.69) at baseline to 6.21 (0.48) post-intervention. Also, the study participants experienced a significant improvement in mean (SD) levels of self-efficacy in the provision of lifestyle care from 5.30 (1.97) at baseline and 6.44 (1.44, $p < 0.001$) at six months post-intervention.

Table5:1.6 Baseline, and six-month follow-up mean lifestyle knowledge, attitude and self-efficacy scores of participants compared using repeated measurement test, 2019 (n=128).

Variables	**Baseline**	**6-month Follow-up**	**Change**	**P**	**ή²**
Lifestyle-related knowledge	19.49 (3.77)	22.76 (4.89)	3.27(1.12)	<0.001	0.40
Attitude toward the provision of lifestyle care/adaption	4.03 (0.69)	6.21 (0.48)	2.18(-0.21)	0.003	0.01
Level of self-efficacy in the provision of lifestyle care	5.30 (1.97)	6.44 (1.44)	1.14(-0.52)	<0.001	0.30
*p < 0.05; ** p < 0.01; ***p < 0.001.					

4. DISCUSSION

Theory-based lifestyle educational intervention through intensive community leaders affects healthy lifestyle adoption. This study was designed to evaluate participants' adoption, retention,

and effectiveness of team-based lead healthy lifestyle educational intervention targeting middle-aged Nekemte populations. The overall findings were positive showing that, the program adoption rate was high amongst the intervention group. Post-intervention assessments showed improvements in most behavioral and anthropometric parameters measured. Our finding revealed that team leaders-based healthy lifestyle educational intervention could effectively increase the percentage of the overall healthy lifestyle practices of middle age. This intervention had a significant reduction in adulthood's central obesity and hip circumference, with no significant reduction in adults' body mass index.

In this study adoption and retention of participants were high because of the community team leader's effort. Similar to our study, group-based healthy lifestyle intervention delivered in rural and underserved communities is acceptable; to improve retention of participants and the effectiveness of the program (Maher, C.A, *et al.*2021). Regarding recommended physical activity level; self-reported physical activity increased by 38.6%, representing a very significant change compared to both baseline and control groups and a clinically meaningful increase. It is important to acknowledge that these are self-reported changes, which are susceptible to social-desirability bias (Adams, 2005).

The magnitude of this study on blood pressure is high compared to the study in Sweden. Rachel Treasure W. points out the work of Nicoll and Michael Y Henein, that lifestyle modification effectively can lower blood pressure by at least as much as a single antihypertensive drug. Even a 2 mmHg decrease in diastolic blood pressure has been found to reduce hypertension prevalence by 17%, the risk of coronary heart disease by 6%, and stroke by 15% (Treasure W. ,2010).

The effectiveness of the educational intervention was evaluated using all constructs of Pender's model (HPM) on the adoption of a healthy lifestyle among the middle-aged Nekemte population. At six months of follow-up intervention, all of the positive effects of the HPM intervention were sustained particularly on self-efficacy, related behavior, perceived benefits, perceived barriers, and interpersonal influences. This success of the HPM intervention may be related to useful theoretical mediator constructs and intensive community leaders or it may be due to specific behavior change techniques. Similarly, Van Sluijs et al. found positive effects of the HPM intervention on successful behavior changes at a 6-month follow-up (Berry T *et al.* 2008,Twisk JWR *et al*. 2004)also argued that the use of intervention mapping can make health education and

health promotion programs stronger, more effective, and more widely disseminated to improve the impact of public health programs.

A correlation analysis was conducted considering team leadership as the independent variable. While dependent variables include: the effectiveness of the intervention, the effort of leaders, and the satisfaction of participants. Results reveal high correlations between team leadership and performance measures. Team leadership is significantly associated with effectiveness ($r = 0.82$, $p < 0.01$), effort ($r = 0.73$, $p < 0.01$), and satisfaction ($r = 0.84$, $p < 0.01$). All the team leadership subscales have positive, statistically significant ($p< 0.01$), correlations with effectiveness, leaders' effort, and Satisfaction.

This finding implies that the participants may have demonstrated paramount motivation and commitment in the early stage of the study unless community leaders were not. Effective strategies for maintaining the participants' motivation and commitment in the long term should be explored.

5. CONCLUSION

In conclusion, to the extent of our knowledge, this is the first research to evaluate the effectiveness of the theory-based educational intervention on the intervention mapping approach on healthy lifestyle adoption through intensive community leader's involvement in a community setting in west Ethiopia. TPB-based intervention in changing individual behavior led to the improvement of lifestyle dimensions, TPB constructs, and clinical outcomes. This study improved healthy lifestyle adoption and reduced anthropometric measures among the intervention group compared to the control one. In addition, leading the intervention through community leaders improved the implantation of education, team leader effort, and adult satisfaction. The finding implies theory-based educational intervention through intensive community-based team leadership could have a more positive effect on the implementation of educational intervention, healthy lifestyle adoption, team performance, and satisfaction. In short, the findings imply the need for targeting community participation with intensive community leaders' engagement in designing healthy lifestyle education interventions.

5.2.EFFECT OF LIFESTYLE EDUCATIONAL INTERVENTION ON MODIFIABLE RISK FACTORS OF METABOLIC SYNDROME AMONG MIDDLE-AGED NEKEMTE POPULATIONS: QUASI-EXPERIMENTAL STUDY.

*Redrafted from: Alemu Adeba*1, Dessalegn Tamiru1, Tefera Belachew1.* Effect of Lifestyle Educational Intervention on Modifiable Risk Factors of Metabolic Syndrome among Middle-Age Nekemte Populations: Quasi-Experimental Study**.** Sys Rev Pharm 2022; 13(10): 968-974, A multifaceted review journal in the field of pharmacy. N 0976-2779 P-ISSN 0975-8453 / DOI: 10.31858/0975-8453.13.10.968-974.

ABSTRACT

Background: Unhealthy lifestyles are potential risks for the development of metabolic syndrome and associated disorders. However, the effect of educational intervention on modifiable risk factors of metabolic syndrome was not given and measured in West Ethiopia.

Objective: To evaluate the effect of a healthy lifestyle education intervention on modifiable risk factors of metabolic syndrome.

Methods: A pre-post-test nonequivalent control quasi- experimental design was applied from 1st February to 30th of July, 2019 on middle-aged Nekemte populations of Western Ethiopia. The intervention group received healthy lifestyle education while nothing was given for control. Change in prevalence of metabolic syndrome was measured at baseline and post-six-month intervention. On logistic analysis, statistical significance was declared at $p<0.05$.

Results: Common modifiable behavioral and physiological risk factors of metabolic syndrome measured at baseline and end-line. A total of 266 middle-aged adults were included at baseline and 253 participants completed the intervention period. The study showed the overall prevalence of metabolic syndrome and associated factors changed within six months of intervention. The prevalence of metabolic syndrome and elevated blood pressure declined by 2.36% and 4.79% respectively as compared to baseline. Similarly, the mean of central obesity and systolic BP decreased by 1 ± 1.1 (P=0.001) and 0.46 ± 3.06 respectively. The effect size of the mean and standard deviation of physical activity after the intervention was 223.90±21.20. After adjusting for variables on Generalized linear Regression, the intervention group and the control group were

statistically significantly different in the following post-education outcomes: WC (F =33.61, P=0.007), TGs (F =18.32, P< 0.001), BP (F = 31.95, P < 0.0001) and low HDL-cholesterol (F =14.91, P < 0.001).

Conclusion: This educational intervention on a healthy lifestyle significantly improves the prevalence of modifiable risk factors of metabolic syndrome. We recommend lifestyle education in routine care for patients with metabolic syndrome. These findings indicate that large-scale community-based structured and intensive intervention is the research outlook.

Keywords: *Metabolic syndrome, HDL-cholestrol, Blood pressure*

1. INTRODUCTION

Nowadays metabolic disturbance is a global issue (Alberti KG, *et al.*, 2009); however early diagnosis at community level has not been adopted (Blaha MJ, *et al*., 2008; Grundy SM, *et al*., 2005). Health is an essential attainment in human life to improve quality of life and avoid chronic diseases and reduce premature death(Kieny MP, *et al*., 2017). The individuals' lifestyles and choices are necessary to be healthy and enhance life(Nies MA and McEwen M, 2014; Zeidi MI, *et al*., 2012).

Unhealthy lifestyle factors are known potential risks for the development of metabolic syndrome(Trinh OT, *et al*., 2010; Duc Son LE, *et al*., 2004), special in developing countries. Having one or more: unhealthy diets, tobacco use, risk of alcohol drinking, and physical inactivity increases mortality risk (Loef M and Walach H, 2012; Hoevenaar-Blom MP, *et al*., 2014; Gómez DM, *et al.*, 2013.

Lifestyle intervention reduces metabolic risk development Yamaoka K and Tango T, 2012; Mohamed SA, 2014; Muchiri JW, *et al*., 2016; Makrilakis K, *et al*., 2012). A healthy diet and physical activity in reducing rates of disability and death from chronic diseases have been well-established in developed countries (McNulty J, *et al.*,2013). Optimal health and wellness are achieved when patients adopt positive lifestyle behaviors (Kushner RF, *et al.*,2014).

The magnitude of metabolic syndrome is rapidly increasing globally across populations(Oguz A., *et al*.,2008) and almost one-quarter of adults have metabolic disorder (IDF, 2006). The prevalence of metabolic syndrome varies, ranging from 10% to 84% depending on the region,

sex, age, and ethnicity of the population being studied (Alberti KG, *et al*., 2009; Blaha MJ, *et al*., 2008; Grundy SM, *et al*., 2005). In Africa, the prevalence of chronic diseases increasing at an alarming rate which poses a great public health challenge in Sub-Saharan Africa (Motala A and Ramaiya K, 2010). This scenario was amended by different studies in Ethiopia (Sinaga M, *et al*., 2018; Abrha S, *et al*., 2016; Tefera G, 2014; Abda E, *et al*., 2016; Asfaw HA, *et al*., 2015; Tolu G, *et al*., 2016; Tran A, *et al*., 2011). Still, there is insufficient data regarding the effect of healthy lifestyle education on the prevalence of metabolic syndrome and physiological risks in West Ethiopia. This study evaluated the effect of a month of healthy lifestyle educational intervention on modifiable risk factors of metabolic syndrome among middle-aged Nekemte populations in western Ethiopia.

2. MATERIALS AND METHODS

2.1. STUDY AREA

The Study was conducted in Nekemte Town, Oromia National Regional State, and Western Ethiopia(see Chapter-2 for a detailed description of the study settings).

2.2. STUDY DESIGN

A pre-test and post-test control group quasi-experimental independent samples design were applied to evaluate the change because of education between the intervention and control group on metabolic syndrome and its modifiable risks among middle-aged urban residents. The education was given from February 1st to 30 July 2019 for the intervention group and post-test data was collected in August 2019.

Intervention : 01a X 02a

Control group: 01b X 02b

2.3. RECRUITMENT OF PARTICIPANTS AND SAMPLING TECHNIQUES

The sample size was calculated using detecting differences between two independent variables, taking the prevalence of dependent variable among healthy Ethiopian adults; the most common

prevalent was abdominal obesity with 19.6%: with 0.4 effect sizes, the margin of error of 5%, a confidence level of 95% and 30% gnawing away, a minimum sample of 266 participants. From six communes of Nekemte city, one commune was randomly selected and the other was purposively allocated with a buffering zone through natural geographical boundary to avoid information contamination. Grouping participants, (n=133) were grouped into intervention and under-planned healthy lifestyle education for 6 months. Healthy lifestyle education was presented to the participants using teaching aids by professionals. During the training sessions, a guide to improving healthy lifestyles for the adults, like a healthy diet, physical activity, smoking, risk alcohol, and chat; as well as metabolic syndrome facts listed in the training manual were given to the intervention group with command(see Chapter 2).

2.4. SYSTEM OF INTERVENTIONAL ORGANIZATION

The following three phases were implemented among the adults selected for the study: baseline survey; intervention for case group; and evaluation (post-assessment) phases. There is strong evidence showing that chronic diseases can be prevented and controlled through comprehensive and integrated actions. Having this idea, a community-based healthy lifestyle education for reducing the risk of developing metabolic syndrome, compartments, and its health outcomes. The intervention comprises leaflets, healthy lifestyle education sessions, and mass walking that provide information and encourage participants to improve their physical activity and healthy eating behaviors during the three months. The control group participants received standard/routine health information and one-time advice during baseline. Measurements were taken at baseline and post-intervention to evaluate program effectiveness and improvement of health-related quality of life. This means quasi-experimental designs with untreated non-equivalent control group designs with pre-test and post-test. During education sessions the participants (n=133) in the intervention commune were divided into four groups, that is, eight teams, 33 participants per group, and one general leader. Systematically; the team, single group, and whole groups were organized to control the process. The timetable for intervention was stated deeply in Chapter 2.

2.5. ELIGIBLE CRITERIA

All adults aged [41-64 years] full fill inclusion criteria were selected while individuals receiving medication for NCDs; have taken part in any behavioural change program; pregnant/current lactating women; serious mental conditions; bariatric surgery; use of weight-impacting medication and physically disables was excluded(See Chapter 2).

2.6. DATA COLLECTION AND ANALYSIS

Data were collected by the World Health Organization's Stepwise approach to non-communicable disease surveillance (Grave DR, *et al*., 2010). First, necessary information was collected by a structured questionnaire. In phase two anthropometric measurements were taken by using the SECA weight measuring scale, measuring tape at the midpoint of the inferior margin of the last rib and the iliac crest at the end of expiration (Weigensberg MJ, *et al*., 2014), and Blood pressure was measured by sphygmomanometer from the right arm after participants rested for five minutes. In the third phase of the biochemical analysis, five milliliters (5ml) of fasting venous blood was taken from each study participant. After allowing the formation of clots by staying the whole blood for 30 minutes, the serum was separated by centrifuging the clotted blood at 3,000 revolutions per minute. Blood glucose and lipid profiles were determined from serum blood using the DIRUI CS-T240 Auto chemistry analyzer by laboratory technologists following the standard operating procedures.

The data were collected at baseline and end line then checked, entered into a pre-drafted coding sheet on Epi-info software (version 3.5.3) by two different data clerks, and analyzed using SPSS software (version 24, SPSS Inc., Chicago, IL, USA). Besides with the normality and abnormality distribution of data: descriptive statistics and inferential statistical tests were used. All linear variables with normal distribution are expressed as mean ± SD scores. Binary logistic regression determines the odd ratio between the effect of healthy lifestyle education and the presence/absence of metabolic syndrome. The effectiveness of the education was evaluated by comparing interventions that have taken education and comparison groups for the outcome measures using a generalized linear equation model. The significance level was considered at alpha as $p<0.05$.

2.7. DATA QUALITY MANAGEMENT

Questionnaires are prepared in English, and translated to Afan Oromo and back to English by experts in the language to keep its consistency. The training was given to data collectors and supervisors on the tools and data collection methods by the Principal investigators. Monitoring of intervention implementation was conducted by the principal investigator and supervisors. Filled questionnaires were checked for completeness and entered into software. To keep data quality and avoid measuring bias, the study objective and hypothesis were hidden from data collectors.

2.8. ETHICAL APPROVAL

The research protocol was approved by Jimma University; Institute of Health; Institutional Review Board, consent form and confidentiality of the respondents were secured (See Chapter 2).

3. RESULTS

3.1. Lifestyle Behaviours And Participants Characteristics

Two hundred sixty-six undiagnosed participants for metabolic syndrome, of those the majority (62.8%) of them were females. Regarding income, more than half (54.89%) of the participants live below the poverty threshold (<$1.25). Besides socio-demographics, healthy lifestyle behavior was assessed, accordingly, few of the participants (2.3%) were currently smoking cigarettes, 9.8% of participants currently drink risk alcohol, and 1.1% chew khat. A large proportion of participants (91.0%) were engaged in low physical activity. Similarly, more than half (68%) of them consumed an unhealthy diet and 75.2% of them had an adequate sleep pattern or were deprived (Table4.2.2).

3.2. Effect of Community-Based Education on Lifestyles Practices

At baseline, there were no significant differences ($P > 0.05$) in the demographic measures from the control and intervention groups. Two hundred fifty-three (95.11%) of the participants completed the six-month intervention from 266 samples. Comparatively high dropout (6.02%) was seen in the control group than intervention (3.76%). The number of current smokers in the intervention group reduced from 3.8% to 2.3%. Similarly, current alcohol drinkers withdrew by

9.4% from 11.3% and chat chewers declined from 1.5% to 0.8%. Besides the four major modifiable lifestyle factors, the prevalence of inadequate sleeping patterns decreased by 19.5% among the intervention group during the post-test(Table 5:2.1).

Table 5:2.1: Effect of educational intervention on lifestyle factors, Nekemte, Ethiopia, 2019

		Intervention Group %			Control group (%)		
Variable	Categories	Pretest	Post-test	P-value	Baseline	End lines	P
DDS</≥7 group	Low	127(95.5)	90(70.3)	<0.001	130(97.7)	114(91.2)	<0.001
	High	6(4.5)	38(29.7)		3(2.3)	11(8.8)	
Physical activity	Low	120(90.2)	66(51.6)	0.184	122(91.7)	103(82.4)	0.369
	High	8(9.8)	62(48.4)		11(8.3)	22(9.6)	
Smoking	Currently	5(3.8)	1(0.8)	<0.001	1(0.8)	1(0.8)	<0.001
	Quit	12(9)	9(6.8)		9(6.8)	6(4.8	
Risk alcohol	Currently	15(11.3)	11(8.3)	0.166	11(8.3)	9(7.2)	0.001
	Quit	28(21.1)	12(9)		12(9)	11(8.8)	
Khat	Currently	2(1.5)	1(0.8)	0.408	1(0.8)	0	<0.001
	Quit	13(9.8)	5(3.8)		5(3.8)	6(4)	
Sleep	<6hrs/day	81(60.9)	53(41.4)	0.130	119(89.5)	102(81.6)	0.279
	6-9hrs/day	52(39.1)	75(58.6)		14(10.5)	23(18.4)	
Individuals have low (irregular physical activities) and do them fewer than three times a week and 30 minutes each time.							

The T-test results showed the mean and standard deviation of physical activity in the intervention and control groups before and after the intervention were different. After the educational intervention, the mean score of physical activity was significantly higher in the interventional group than in the control group (P< 0.001). The findings of the paired t-test showed that the mean score of physical activity before and after the educational intervention was significantly different in the intervention group (P=0.01), but no significant difference was found in the control group (P=0.625). The effect size of healthy lifestyle education on physical activity was 223.90±21.20. In addition, the T-test results showed that before the intervention, there was no significant difference between the mean score of perceived self-efficacy in the two groups

(P>0.05), however after the intervention, the mean score of perceived self-efficacy was significantly changed among intervention group (Table 5:2.2).

Table 5:2.2 Mean and standard deviation of physical activity before and after intervention in the case and control groups.

Groups	Baseline		After lifestyle education		P-value
	Mean	SD	Mean	SD	
Intervention	358.80	128.50	578.30	101.90	0.000*
Control	351.60	94.90	354.40	80.70	0.625
Difference of difference			223.90	21.20	0.001
Self-efficancy of IG	17.97	3.86	20.21	3.57	0.001
Self-efficancy of CG	16.84	4.31	17.58	3.75	0.231

Paired t-test* , Independent t-test**, IG =Intervention group, CG=Control group, SD: Standard deviation

The proportion of Food groups consumed at least once on the last day during the post-test by Nekemte Populations was displaced in (Table 5:2.3). The most consumed food groups in the study area were cereals/grains. The dietary diversity intake of the control group at the six-month post-test was almost similar to the baseline. However, there was a slight deviation in the intervention meaning middle-aged Nekemte residents regarding consuming healthy diet like fruits (44.53%), vegetables (53.91%) and 60.16% did not consume saturated fat showed change. In Nekemte, HDDS was stratified using a wealth index. Accordingly, baseline HDDS and end-line HDDS had big differences among the intervention group. However, there was no significance difference seen between baseline HDDS and end line among the control group.

Table5:2.3 Proportion of Food groups consumed at least once in the last seven days during post-test by Nekemte Populations, western Ethiopia, 2019.

Food groups		Intervention Group (%)	P	Control group (%)	P
Fruits (Papaya, Mango, Avocado, Banana, Pineapple, Oranges)	Yes	57(44.53)	0.004	12(9.6)	0.000
	No	71(55.47)		113(90.4)	
Vegetables (Carrots, Tomato, Green leafy vegetables)	Yes	59(53.91)	0.717	35 (28%)	0.286
	No	69(46.09)		90(72%)	
Tuber and root (Potato, Sweet potato, anchote, Kocho, cassava)	Yes	50(39.1)	0.001	39 (68.8)	0.091
	No	78(60.9)		86(90.4)	
Cereals (Teff, Wheat,Sorghum, Barley, Maize, Rice, millet)	Yes	128(100)	0[a]	125(100)	0[a]
	No	0		0	
Legumes and pulses (pea, beans, soybean, lentils, nut, Niger seed)	Yes	95(74.22)	0.983	90(72)	0.001
	No	33(25.78)		35(28)	
Meat products (Beef, Eggs, mutton , Fish, Chicken,)	Yes	30(23.44)	0.727	2(1.6)	0.336
	No	98(76.56)		123(98.4)	
Saturated fat (clotted oil, animal butter)	Yes	51(39.84)	0.095	89(71.2)	0.215
	No	79(60.16)		36(28.8)	
Dairy products (Milk, yogurt, cheese,)	Yes	10(7.8)	0.614	2 (1.6)	0.336
	No	118(92.2)		123(98.4)	
Eggs	Yes	28(21.88)	0.189	5(4)	0.495
	No	100(78.12)		120(96)	
		Baseline	End line	Baseline	Endline
Household dietary diversity score based on 12 food groups (0-12)	Low	106(79.7)	66(51.7)	102(76.7)	97(77.6)
	Mediur	21(15.6)	41(32.0)	27(20.3)	23(18.4)
	High	6(4.5)	21(16.3)	4(3.0)	5(4.0)

Lowest DD ≤ 3 food groups; Medium DD =4 and 5 food groups, High DD ≥ 6 food groups

3.3. MEAN VALUES OF PHYSIOLOGICAL RISK FACTORS

Comparing the mean and Standard Deviation scores of physiological risk factors, the differences in mean values of biological risks were seen among participants at baseline and post-intervention. Among participants who had taken education; waist circumference, hip circumference, systolic blood pressure, fasting blood sugar, and triglycerides showed reduction in mean and standard deviation by 1.40±1.10, 2.16±2.43, 0.46± 3.06, 1.65±1.80, and 1.51±2.95 respectively. While slight mean ± SD increment was seen in the control group on waist circumference, hip circumference, FBS, and triglycerides as compared to the intervention group (Table 5:2.4).

Table5:2.4 the mean and SD scores of physiological risks, middle aged, Nekemte, Ethiopia, 2019

Variables	**Intervention group (M±SD)**		**Control group (M±SD)**		P
	Baseline	End line	Baseline	Post test	
WC	85.59±7.77	84.19±6.67	85.19±8.96	85.60±8.92	0.001
BMI	23.06±3.59	21.28±2.96	22.65±3.76	22.72±3.79	0.001
Hip circumf.	93.32±8.73	91.06±11.16	93.66±9.38	93.93±9.40	0.001
Systolic BP	117.78±15.85	117.32±12.79	122.26±12.07	122.08±12.3	0.001
Diastolic BP	76.32±9.67	*78.07±5.95*	77.90±8.19	77.72±7.87	0.001
FBS	101.30±25.51	99.65±23.71	89.09±33.20	98.23±34.18	0.001
Triglycerides	129.66±25.83	128.15±22.88	133.60±23.92	133.51±23.80	0.001
HDL-cholesterol	54.47±10.57	54.70±10.56	49.62±9.54	49.54±9.55	0.001
Analysis of Variance (ANOVA)					

3.4. Effect of healthy lifestyle education on modifiable metabolic risk factors

The prevalence of metabolic syndrome declined by 2.36% among the intervention group; but increased by 4.5% in the control group during the month duration. Similarly, the prevalence of blood pressure decreased significantly from 15.79% to 11% (P<0.001) while only a 1.05% decline was seen among the control group. likewise, the prevalence of high fasting blood sugar levels increased significantly from 6.77% to 7.2% (p<0.001) among the control group while declining from 7.52% to 6.25%(p<0.001) in the intervention group. In general, the comparison between the two groups at post-test showed that the prevalence of metabolic syndrome, waist circumference, raised blood pressure, elevated fasting blood glucose, elevated triglyceride, and low HDL cholesterol was more prominent, except central obesity in the control group as compared to the intervention group (Table 5:2.5).

Table5:2.5. Effect of education on modifiable metabolic risk factors, urban, Ethiopia, 2019

Variable		Intervention group (%)			Control group (%)		
		Baseline	Post-test	P	Baseline	Post-test	P
Central obesity	≥90/80cm	62.41%	53.60%	0.093	58%	57.89%	0.005
	<90/80cm	37.59	46.40%		42%	42.11%	
BMI	≥25Kg/m^2	27.82%	26%	<0.001	23.31%	23%	<0.001
	<25Kg/m^2	72.18%	74%		76.69%	77%	
BP mmHg	>130/85	15.79%	11%	<0.001	21.05%	20%	<0.001
	<130/85	84.21%	89%		78.95%	80%	
FBS mg/dl	>100	7.52%	6.25%	<0.001	6.77%	7.2%	<0.001
	<100	92.48%	93.75%		93.23%	92.8%	
TG mg/dl	>150	16%	15.79%	<0.001	19.55%	20%	<0.001
	<150	84%	84.21%		80.45%	80%	
HDL-C	<40/50	15.79%	15.63%	<0.001	23%	23.2%	<0.001
	>40/50	84.21%	84.37%		77%	76.8%	
MetS	Yes	19.55%	17.19%	<0.001	20.30%	24.8%	<0.001
	No	80.45%	82.81%		79.70%	75.2%	

High waist circumference for male is >90cm and 80cm for female, HDL-C <40/50 for male/female; MetS: metabolic syndrome

Multivariable linear regression model shows lifestyle education had strong effect on M±SD scores of MetS components at end-line (Fig.5).

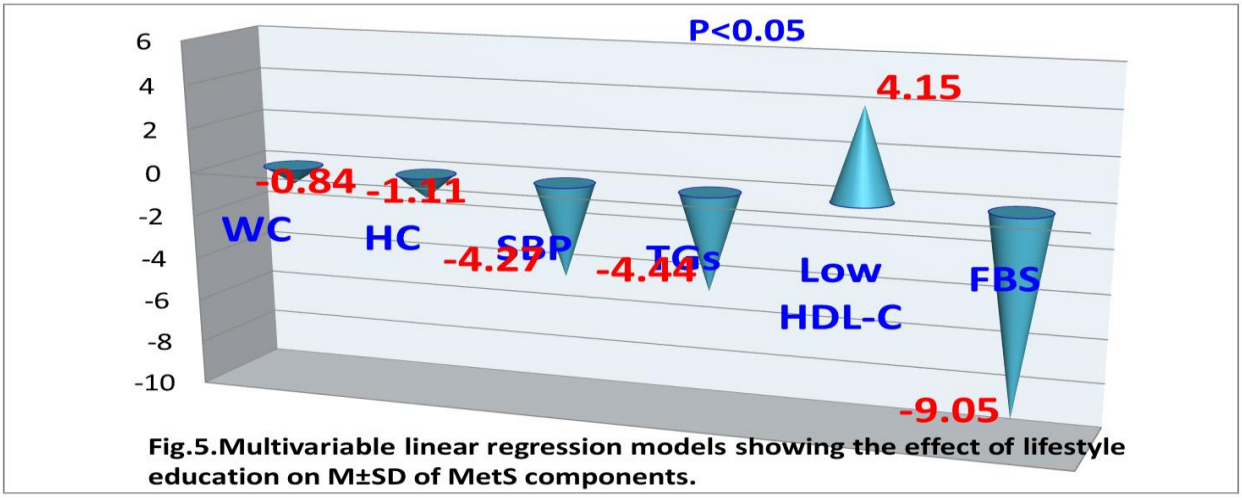

Fig.5.Multivariable linear regression models showing the effect of lifestyle education on M±SD of MetS components.

3.5. Effect of Healthy Lifestyle Education on Metabolic Syndrome

We determined the effect sizes of healthy lifestyle education on metabolic syndrome parameters by generalized linear analysis. After adjusting for variables, the intervention group and the control group were statistically significantly different in the following post-education outcomes: WC (F =33.61, P=0.007), TGs (F =18.32, P< 0.001), BP (F = 31.95, P < 0.0001) and low HDL-cholesterol (F =14.91, P < 0.001). Lifestyle education was protective as compared to the usual or control group (Table 5:2.6).

Table5:2.6 Post-intervention analyses based on Generalized linear Model, Nekemte (n = 253), 2019.

	Intervention group, n=128				**Control Group, n=125**			
Outcome Variables	**Test of effect sizes**		**Parameter estimates**		**Effects size**		**Parameter estimates**	
	F	**P**	β	**95%CI**	F	P	B	**95%CI**
WC	33.61	0.007	0.55	0.35,0.61	35.68	0.013	3.27	1.33,8.04
BMI	19.46	0.001	0.62	0.09,0.84	23.16	0.001	4.86	1.85,12.73
BP	31.95	0.000	0.65	0.21,0.92	33.45	0.000	5.98	2.08,7.16
FBS	23.57	0.021	0.58	0.24,0.77	23.57	0.001	4.38	2.51,8.29
TGs	18.32	0.001	0.54	0.35,0.81	18.32	0.000	7.15	4.52, 9.84
HDL-C	14.91	0.001	0.53	0.08,0.67	19.37	0.000	4.58	2.94,8.19
High WC>90cm/80cm for male/female, High BMI>25kg/cm^2, High BP>130/85mmHg, High FBS >100mg/dl, high TGs>150mg/dl, low HDL-cholesterol <40mg/dl/50mg/dl for male/female								

4. DISCUSSION

This study gave face-to-face healthy lifestyle education for the intervention group for six months based on social cognitive behavioral theory long-term effectiveness of longitudinal study while nothing for the control group other than routine health information. The finding of the study revealed a significant reduction in the prevalence of metabolic syndrome seen in the intervention group compared to the control group.

Lifestyle intervention helps to reduce unhealthy behaviors that increase the risk of developing metabolic syndrome or individual metabolic abnormalities (Armitage P, *et al*., 2008). The study in California among the Latino population showed that sedentary behavior decreased by 38% and moderate physical activity increased by 29% in the guided imagery intervention group when compared to the digital storytelling intervention group (Askari F, *et al*., 2013).

In line with the study, our finding showed physical inactivity declined by 38.6% among individuals who had taken healthy lifestyle education. Additionally, an improvement was also observed in the intervention group in terms of sleep adequacy pattern and increased by 19.5% at the six-month post-test. Similar to this study, nutrition education improved dietary behavior and physical activity (Liu Y, *et al*., 2015; Hutton B and Fergusson D, 2004; TOHP Collaborative Research Group, 1992).

Previous studies confirmed lifestyle interventions have positive outcomes in metabolic parameters (Hutton B and Fergusson D, 2004; Ford ES, *et al*., 2011). The findings of the current study demonstrated constant agreement with those stated studies. Little improvement in the blood pressure risks may have a profound impact on the population's health. Another study in America by trials of hypertension phase one two-kilogram weight loss over six months resulted in a decline of 3.7 mmHg in systolic blood pressure. This study implies that community-based lifestyle education reduces systolic blood pressure by 3.11mmHg and improves health.

5. CONCLUSIONS

Community-based healthy lifestyle educational intervention targeting middle age reduces the prevalence of metabolic syndrome and improves its behavioral lifestyle and physiological factors. This study also found that systolic blood pressure in intervention groups significantly declined by 3.52 mmHg. This implies that community-based lifestyle education reduces systolic blood pressure by 3.11 mmHg and improves health. So, adopting on a wide scale and establishing healthy lifestyle training centers were recommended.

5.3. EFFECT OF HEALTHY LIFESTYLE EDUCATION ON HEALTH-RELATED QUALITY OF LIFE AMONG MID-ADULTHOOD URBAN RESIDENTS OF WEST ETHIOPIA: A QUASI-EXPERIMENTAL STUDY.

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ABSTRACT

Background: Quality of life deteriorates due to unhealthy behaviors. Unhealthy lifestyle practices are high in West Ethiopia; it leads to poor quality of life, however, no intervention there.

Objective: To evaluate the effect of a lifestyle education intervention on quality of life in healthy middle-aged urban residents.

Methods: A quasi-experimental design was applied from 1st February to 30th July 2019 on 266 unscreened healthy adults aged 41-64 years. A face-to-face educational approach was reinforced in 133 intervention participants. The status of quality of life was measured at baseline and post of six-month intervention using EQ-5D and the self-administered Quality of Well-being Scale (QWB-SA) is a preference-weighted measure of health status and overall well-being over the previous three days in five domains of HRQoL tools. Using multinomial logistic regression statistical significance was described at $p < 0.05$.

Results: The intervention group showed significant improvement in health-related quality of life as compared to the control group in six-month lifestyle changes. In the intervention group, the prevalence of poor quality of life declined by 1.2% as compared to the baseline. Likewise, physical activity level, diet diversity, and sleep pattern showed improvement due to lifestyle education intervention. Prevalence of poor quality of life scores significantly declined by 2.5% ($p<0.001$) among participants who had pain/discomfort in the intervention group. The findings revealed that middle-aged adults in the intervention groups had a greater HRQoL than those in the control group at six months (ß=9.7, $P<0.001$) and ß=2.6, $P=0.003$, respectively).

Conclusion: Community-based lifestyle education targeted to middle-aged adults significantly improved health-related quality of life in western Ethiopia.

Keyword: *Healthy lifestyle, Education, Health-related quality of life, Middle-aged*

1. INTRODUCTION

Unhealthy lifestyle behaviors may be long-term risk factors for chronic conditions in adulthood (Ozcanarslan, *et al*.2018). A healthy lifestyle is a way of life that provides, maintains, and promotes the individual's health and wellbeing, and quality of life (Hekmatpou, *et al*.2013).

HRQoL systematically measures the relationship between health and health status with quality of life (QoL) (Samuli I., *et al.* 2006, Van Reenen M, Oppe M. 2015). The ability to identify indicators of poor HRQoL is crucial for both improving clinical care and determining targets of intervention for the prevention and treatment of diseases (Remington, *et al.* 2010). HRQoL assesses how an individual's well-being may be affected by a disease, disability, or disorder over time (Wikipedia. 2016, CDC, 2018).

Despite growing awareness of the importance of HRQOL assessment for adults, much of the research to date has focused on specific diseases. To the best of our scan, in Ethiopia, few studies have attempted to identify predictors of HRQOL among adults (Jufar, *et al*.2017, Kidist, *et al*.2018, Mohammed, *et al*.2017, Gebremedhin, *et al*.2019), but interventions specific to middle-aged adults not given.

Lifestyle behaviors vary from individual level to population. Modifying lifestyle behaviors interventions are aimed at improving the health of the community. However, there is insufficient data regarding the effect of healthy lifestyle education including diet, physical activity, alcohol, and smoking on health-related quality of life. The purpose of this study was to evaluate the effect of six months of healthy lifestyle education on health-related quality of life among middle-aged urban residents of West Ethiopia.

2. METHODS

2.1. STUDY DESIGN AND PERIOD

A pre-test and the post-test group quasi-experimental independent samples were applied to evaluate the change because of healthy lifestyle education effect between intervention and control group on health-related quality of life among middle-aged adulthoods. The education was

given from 1 February to 30 July 2019 for the intervention group and post-test data was collected in August 2019.

2.2. RECRUITMENT OF PARTICIPANTS AND SAMPLING TECHNIQUES

We determined the sample size for each objective using information from different literature and the largest value will be taken to conduct the study. Since there was no prior study at the study site regarding metabolic syndrome, the minimum sample size was calculated using a single proportion formula taking the prevalence of the dependent variable among healthy Ethiopian adults. According to (Girma, A., *et al*. 2011), the most common component of metabolic syndrome is abdominal obesity with 19.6% prevalent. With a margin of error of 5%, Confidence levels of 95%, and 10% gnawing away, a minimum sample of 266 participants. From six communes of Nekemte city, two communes having no adjacent natural bounder but were homogeneous in terms of socioeconomic and geographical were selected. Accordingly, one commune was randomly selected and the other was purposively allocated with a buffering zone through a natural geographical boundary to avoid contamination (See Chapter 2).

2.3. SYSTEM OF INTERVENTION ORGANIZATION

There is strong evidence showing that chronic diseases can be prevented and controlled through comprehensive and integrated actions. Having this, a community-based healthy lifestyle education was given for reducing poor health-related quality of life. The intervention comprises leaflets, healthy lifestyle education sessions, and mass walking that provide information and encourage participants to improve their physical activity and healthy eating behaviors during the three months. The control group participants received standard/routine health information and one-time advice during baseline. Measurements were taken at baseline and post-intervention to evaluate program effectiveness and improvement of health-related quality of life. This means quasi-experimental designs with untreated non-equivalent control group designs with pre-test and post-test. During education sessions the participants (n=133) in the intervention commune were divided into four groups, that is, 33 participants per group and one general leader. To follow the intervention process seriously and reduce the dropout of study participants, systematically the team, each group, and the whole group were organized as shown in the following diagram below (See Chapter 2, Figure 2:4).

2.4. ELIGIBLE CRITERIA

All selected healthy individuals aged 41-64 years who were eligible to participate in the study and asked to undergo personal anthropometric measurements, and respond to questionnaires and biomarkers were included. Individuals receiving medication for NCDs; having taken part in any behavioural change program; pregnant /current lactating women; serious mental conditions; bariatric surgery; use of weight-impacting medication and physical disabilities were excluded.

2.5. DATA ANALYSIS

The data were collected at baseline & end line then checked, and entered into a pre-drafted coding sheet on Epi-info software (version 3.5.3) by two different data clerks. Data were transferred and analyzed using SPSS software (version 24, SPSS Inc., Chicago, IL, USA). Descriptive statistical tests were used, for continues and categorical variables as frequencies and percentages (%). Logistic regression determines the odd ratio between the effect of education and poor HRQoL. The effectiveness of the education was evaluated by comparing intervention and comparison groups for the outcome measures of the HRQOL score. Socio-demographic, lifestyle factors, and clinical variables were used as explanatory variables. A multinomial logistic regression model was used and the significance level was considered at alpha $P<0.05$.

2.6. DATA QUALITY MANAGEMENT

Questionnaires are prepared in English, and translated to Afan Oromo and back to English with guidance of the language experts to keep its consistency. The training was given to data collectors and supervisors on the tools and data collection methods by the Principal investigators. Monitoring of intervention implementation was conducted by the principal investigator and supervisors. Filled questionnaires were checked for completeness and consistency of information by the supervisor daily and entered into software by data clerks and principals. Also to keep data quality and avoid measuring bias, the study objective and hypothesis were hidden from data collectors.

2.7. ETHICAL ENDORSEMENT AND DISSEMINATION

The research protocol was approved by Jimma University; Institute of Health; Institutional Review Board (IRB; Approval No: IHRPGD/596/2019). Individuals, who confirmed their

willingness to participate in the study, signed a consent form. The confidentiality of the respondents was ensured and each individual had an identification number. All participants were provided with an information sheet and asked by the trained data collectors to sign a consent form before beginning healthy lifestyle education and be made aware that they are free to withdraw at any time. The results of the study will be disseminated through conference presentations and publications.

3. RESULTS

3.1. INTERNAL CONSISTENCY AND CORRELATIONS BETWEEN THE DOMAINS OF WHO-QOL: EQ_D5.

Correlation analysis was conducted to examine the relationship between the independent variable (EQ_D5) and the dependent variables (HRQoL). To check the internal consistency, Cronbach's alpha was calculated for each domain of the instrument. All domains of WHO-QoL-Brief had high values of Cronbach's alpha ($\alpha > 0.7$). Interdomain correlation showed that there were statistically significant correlations between domains. The correlation was weak between physical health & social relations as compared to others (Table 5:3.1).

Table 5:3.1 internal consistency & Correlations analysis among domains of the WHO-QoL – Brief

Domains	Cronbach's alpha	Mobility	Self-care	Pain/ discomfort	Anxiety/ depression	Usual activity
Mobility	0.90	1.00				
Self-care	0.81	0.79*	1.00			
Pain/discomfort	0.78	0.65*	0.76	1.00		
Anxiety/depression	0.77	0.59*	0.50*	0.57*	1.00	
Usual activity	0.75	0.55*	0.55*	0.61*	0.51*	1.00
Correlation is significant at the 0.05 level (2-tailed)						

3.2. LIFESTYLE BEHAVIOURAL CHANGES DUE TO EDUCATION

By classifying healthy lifestyle scores, 8.8% of them have zero, 72.7% had 1-2 unhealthy lifestyles, and ≥3 unhealthy practices account for 19.5%. Most outcome expectations significantly changed in the intervention compared to the comparison group. Regarding physical activity, most individuals in the intervention and control groups showed low activity at baseline, 95.5% and 97.7% respectively. The corresponding post-test values were 51.6% for the intervention and 82.3% control group. Likely dietary diversity score of the intervention group showed significant improvement (70.2%; p<0.001) (Table 5:3.2).

Table 5:3.2 Community-based lifestyle education effect on lifestyles ,urban, Ethiopia, 2019

		Intervention Group			Control group		
Variables	Categories	Pretest (%)	Post-test	P	Baseline	post-test(%	P
Physical activity	Low	120(90.2%)	66(51.6%)	0.184	122(91.7%)	103(82.4%)	0.369
	Moderate+vigor	8(9.8%)	62(48.4%)		11(8.3%)	22(9.6%)	
Smoking	currently use	5(3.8%)	1(0.8%)	<0.001	1(0.8%)	1(0.8%)	<0.001
	Yes, quit now	12(9%)	9(6.8%)		9(6.8%)	6(4.8%	
Alcohol	currently use	15(11.3%)	11(8.3%)	0.166	11(8.3%)	9(7.2%)	0.001
	Yes, quit now	28(21.1%)	12(9%)		12(9%)	11(8.8%)	
Khat chewing	currently use	2(1.5%)	1(0.8%)	0.408	1(0.8%)	0%	<0.001
	Yes, quit now	13(9.8%)	5(3.8%)		5(3.8%)	6(4%)	
Sleep deprivation	<6hrs/day	81(60.9%)	53(41.4%)	0.130	119(89.5%)	102(81.6)	0.279
	6-9hrs/day	52(39.1%)	75(58.6%)		14(10.5%)	23(18.4%)	

3.3. PERCENTILE CHANGE ACROSS EACH ELEMENTS OF EQ_5D

This result showed that poor HRQoL scores slightly decreased in six-month intervention all over EQ_5D, except for self-care problems as compared to the control group. Poor HRQoL scores significantly declined by 2.5% (p<0.001) among participants who had pain/discomfort in the intervention group as compared to baseline. Slightly the prevalence of anxiety/ depression

significantly increased by 0.8% (p<0.001) among the control group as compared to baseline while little decline was obtained in the intervention group (Table 5:3.3).

Table 5:3.3 Change in quality of life scores between baseline and post of healthy lifestyle education, west Ethiopia, 2019.

Poor HRQoL * EQ_5D Problem		Intervention Group (%)				Control group (%)			
		Baseline	End Line	Change	P-Value	Baseline	End Line	Change	P-Value
Pain/ discomfort	No	83.5	85.9	-2.4		86.5	87.2	-0.7	
	Yes	16.5	14.1	+2,4	<0.001	13.5	12.8	+0.7	<0.001
Anxiety/ Depression	No	83.5	83.6	-0.1		88	88.2	-0.2	
	Yes	16.5	16.4	+0.1	<0.001	12	11.2	+0.8	<0.001
Self-care	No	100	100	0		98.5	98.4	+0.1	
	Yes	-	-		NS	1.5	1.6	-0.1	0.002
Usual activity	No	92.5	93	-0.5		97.7	97.6	+0.1	
	Yes	7.5	7	+0.5	<0.001	2.3	2.4	-0.1	<0.001
Mobility	No	94.7	95.3	-0.6		92.5	92.8	-0.3	
	Yes	5.3	4.7	+0.6	<0.001	7.5	7.2	+0.3	<0.001

3.4. Evaluation of changing scores of EQ-D5 and HRQoL

Table 5:3.4 shows the generalized estimating equation analyses and adjustment for EQ_D5 covariates for the effectiveness of lifestyle education on HRQoL and its domains. The findings revealed that middle-aged adults in the intervention groups had a greater HRQoL than those in the control group (case (ß=9.7, P<0.001) and control (ß=2.6, P=0.003). Adults attending lifestyle education had fewer pain/discomfort symptoms compared with those in the control group at six months (ß =-2.9; P < 0.001, and ß =-1.7, P = 0.004, respectively). Middle-aged adults in the intervention group also had fewer anxiety/depressive symptoms compared with those in the control one (ß =-3.8, P < .001).

Table 5:3.4. Evaluation of the healthy lifestyle education's effect on domain of HRQoL and health-related quality of life based on Generalized Estimating Equation Analysis, west Ethiopia, 2019.

Variables	Group	Estimate(β)	SE	95%CI		Z	P
				Lower	Upper		
HRQoL	Intervention	9.7	2.81	-1.67	3.44	23.5	<0.001
	Control	2.6	1.52	-5.79	-2.41	5.1	0.003
Mobility	Intervention	8.3	2.1	1.21	6.82	7.9	<0.001
	Control	1.7	1.3	-1.62	3.95	1.0	0.839
Self-care	Intervention	3.8	4.7	3.79	9.16	14.7	<0.001
	Control	1.4	1.8	1.67	5.17	4.9	0.027
Usual activity	Intervention	9.2	5.40	1.28	23.04	12.7	<0.001
	Control	5.3	2.25	0.26	5.79	6.4	<0.001
Pain/ discomfort	Intervention	-2.9	0.7	5.83	17.15	13.5	<0.001
	Control	-1.7	0.4	0.79	3.65	2.7	0.004
Anxiety/ depression	Intervention	-3.8	1.58	0.60	4.19	15.3	<0.001
	Control	-1.5	2.5	6.7	16.4	4.7	0.037

4. DISCUSSION

This study gave face-to-face healthy lifestyle education for the intervention group for six months based on the long-term effectiveness of the longitudinal study while nothing for the control group rather than routine health information. The finding of the study revealed a reduction in the prevalence of poor HRQoL and significant improvement of lifestyle practices was seen in the intervention group long-term compared to the control group.

Lifestyle education intervention helps to reduce unhealthy behaviors that increase the risk of developing metabolic abnormalities and reduce quality of life (Riccardo, *et al*.2010). The study in California among the Latino population showed that sedentary behavior decreased by 38% and moderate physical activity increased by 29% in the guided imagery intervention group when compared to the digital storytelling intervention group (Marc J., *et al*.2014).

Other study conducted on physical activity and quality of life shows that increased physical activity has a positive impact on various aspects of quality of health (Luke S., *et al*.2006).

Adopting physical activity and dietary habit enhanced the HRQoL (Claudio, *et al*.2002, Discigil, *et al*.2007, Askari, *et al*. 2013). The result of this study also shows that the intervention group showed significant change in major modifiable lifestyle behaviors and slight improvement was obtained on health-related quality of life.

In line with the above studies, our findings showed physical inactivity declined by 38.6% among individuals who had taken healthy lifestyle education. Additionally, an improvement was also observed in the intervention group in terms of sleep adequacy pattern and increased by 19.5% at the six-month post-test. As found in the current study, nutrition and health education have been previously shown to improve dietary behavior and physical activity (David W., *et al*.2003, Armitage, *et al*. 2008, Liu, Yan, *et al*.2015).

We used depression remission (a binary/dichotomous indicator of the absence of depression based on a person's depression score relative to a reference cutoff score; < 10 on the Patient Health Questionnaire-9 (Patel, *et al*. 2017). Depression substantially impairs the quality of life, social functioning, and workforce participation among people with the disease, their family members, and their communities, with an annual global cost attributable to depression estimated at US1.15 trillion. In general, health-related quality of life showed improvement in six months of intervention on participants who had undergone healthy lifestyle educational interventions.

5. CONCLUSION

The prevalence of health-related quality of life and its EQ_5 Dimensions were found to improve more among adults who underwent healthy lifestyle education for six months as compared to the control group in Nekemte Town.

CHAPTER 6: GENERAL DISCUSSION, CONCLUSIONS AND RECCOMENDATIONS

6.1. INTRODUCTION

Metabolic syndrome is a group of risk factors that increase the chance of developing heart disease, stroke, diabetes, and other NCDs. Obesity is a type of chronic disorder categorized as excessive accumulation of body fat in general or abdominal and books more than one billion people. It is one of the most common metabolic problems that affects about 13% of adults internationally. Obesity-related issues can bring chronic inflammation, gut microbiota dysbiosis, vascular epithelial cell dysfunction, and sleep disorders to promote chronic disorders (CKD, CVD, NAFLD, T2D, and cancers) (Sanders, P.*et al*.2021, Zocchi, M.*et al*. 2022).

In least-developed countries, unhealthy lifestyles in adults and elderly age are major modifiable risk factors for lifestyle diseases. In low-income countries, the age-targeted lifestyle education intervention did not get attention regarding health and nutrition policies, strategies, and programs at the national. Likewise, NCDs are a major public health and socioeconomic problem in the 21st century in developing countries. Wrongly appealing lifestyle behaviors increase mortality risks (Loef M, and Walach H. 2012, Verschuren WM, *et al*.2013, Martinez-Gomez D.et al. 2013) and/or increase the risk of NCDs (Li Zhang *et al*. 2017).

However, adopting a healthy lifestyle achieves optimal health and wellness (Kushner *et al., 2014*) and many chronic diseases can be delayed, prevented, or managed through it (Dietz *et al*.,2016); the prevalence of poor lifestyle practices was high. In recent years, most studies have investigated the relationship between obesity and cardiovascular diseases like hypertension. Growing obesity emergence is one of the major sources of unsustainable health costs and earlier onset of morbidity and mortality due to hypertension (Moges B. *et al*. 2014). Consequently, health promotion targeting the middle-aged is considered an effective intervention for current health problems as well as the health challenges in the late adults and elderly (Adeba *et al*. 2021).

Chronic conditions will be becoming the leading cause of death worldwide in 2030 (WHO, 2015). WHO projects that, the high bereavements from CVD, cancer, respiratory disease, and diabetes will highly occur in developing countries over 10 years (WHO, 2005). Similarly, by

2030, the prevalence is projected to rise to 522 million (9.9%) (IDF, 2011). Preventive health behaviors help to prevent or alleviate the suffering and early mortality related to NCDs (CDC, 2009).

Poor lifestyle and HRQoL among adults and above are major problems and remain high-risk behaviors of a lifetime. Studies showed that low and middle-income countries account for 80% of the burden of NCDs globally (Lancet, 2007). Measures to reduce salt intakes by 15%, tobacco use by 20%, and scale up access to low-cost treatment by 60% to those at high risk could avert more than 31 million deaths over 10 years and would cost on average $0.36 per person per year (Lancet, 2007).

Community-leaders-led Health Promotion Model-based lifestyle interventions used in MetS management and effective in improving MetS, HRQoL, adults' self-efficacy, and health-promoting behaviors in six months. The findings of this dissertation showed that poor lifestyle has a significant contribution to metabolic syndrome development among adults. The association of individuals' health and quality of life with lifestyle accounts for 60% (Rasmussen VB, et al., 2004). Millions of people practice an unhealthy lifestyle and they will encounter illness, disability, and even death in later life.

Unhealthy lifestyle practice affects adults' health quality due to different factors like depression and mobility problems (Belachew *et al*.,2015). These factors impose challenges to the achievement of sustainable development goals in developing countries (Sinaga *et al*., 2018). The theory of planned behavior, by holding face-to-face meetings along with following up the samples after the educational intervention, can promote a healthy lifestyle in pre-diabetic women (Roozbahani, N. *et al*.,2022). The findings of this study imply the need to strengthen different programs like Nutrition education and other programs that are focused on reducing non-communicable diseases (Chapters 3-6)). Additionally, the key findings of the Lancet Series on nutrition showed that nutrition-sensitive programs in agriculture, social welfare, early child development, and schooling can be successful at addressing several underlying determinants of nutrition which are the key contributors to malnutrition. Nutrition-sensitive development seeks to integrate and promote nutrition as a goal of multiple sector policies to accelerate national development (Horton *et al*. 2013).

The findings of this dissertation research emerge from nine studies that used community-based cross-sectional designs (Chapter 3.1, 3.2; 3.3, 3.4, and 4.1, 4.2), and pre & post-test non-equivalent control quasi-experimental design (Chapter 5.1, 5.2, 5.3). Generally the study:

- Determined the association of metabolic syndrome with health-related quality of life (Chapter 3:1), which will indicate age-targeted community-based lifestyle education and early detection are significant in reducing its burden (Published: *DOI: 10.54608.annalsmedical.2023.119*).
- Well-founded healthy dietary practice and associated factors (Chapter 3:3), which will indicate age-targeted community-based face-to-face lifestyle education through intensive participation of community leaders is significant to reduce its affliction *(Published on: **doi: 10.3389/fnut.2023.1259024**).*
- Resolute barriers and facilitators in adopting healthy lifestyles (Chapter 3:4), which demonstrated that bonding, bridging, and linking social capital could work as barriers and facilitators for adopting healthy lifestyles in urban residents of western Ethiopia *(Published on: **DOI: 10.32996/ jmhs.2021.2.1.3**.).*
- Determined the sunclinical undiagnosed diabetes mellitus among apparently healthy middle-aged urban populations in west Ethiopia (Chapter 4:1), which will indicate age-targeted community-based education and early detection are significant to reduce its burden (*Published on: **Ethiop Med J, 2022, Vol 60, No, 1**).*
- The investigated peak risk of onset of diabetes among the middle-aged urban population (Chapter 4:2). Since the peak age for onset of diabetes is 40-48 groups for middle-aged adults, it is suggested better to start screening following nearly mid of life expectancy in Ethiopia (*Published on: **African J. Diabetes Med.Vol.29 No 6.2021. ISSN: 2053-4787***).

- Demonstrated the effect of theory-based lifestyle education on lipid profiles, fasting blood sugar, and anthropometric measurements among Nekemte middle-aged adults using a prospective cohort study (Chapter 5:1). Theory-guided lifestyle education delivered through community leaders' involvement improved healthy lifestyle adoption of middle-aged adults (*Published on:* ***Medicine*** *(2023) http://dx.doi.org/10.1097/ MD.0000000000031414*).
- Demonstrated the effect of a healthy lifestyle education intervention on modifiable risk factors of metabolic syndrome using a quasi-experimental design (Chapter 5:2). The results showed that lifestyle education improved modifiable risk factors of metabolic syndrome among middle-aged adults of Nekemte Town, which is aimed at contributing to the preventive efforts (*Published in 2022****;*** DOI: 10.31858/0975-8453.13.10.968-974).
- Demonstrated the effect of a healthy lifestyle education intervention on health-related quality of life using a quasi-experimental design (Chapter 5:3). The results showed that lifestyle education improved the quality of life among middle-aged adults of Nekemte Town, which is aimed at contributing to the preventive efforts (*Available online www.ijmrhs.com, 2021*).

This Ph.D. dissertation also showed urban lifestyle had a significant contribution to adults' metabolic disorders. A likely study confirms urban lifestyle leads to nutrition problems like using fast foods and poor foods, increasing problems like cardiovascular (Mozaffarian D, *et al*. 2011). Therefore, efforts should be made to improve community health workers' capacity and to strengthen the state of health at any age influenced by what is eaten. Adult Nutrition is the foundation for Elderly/ Geriatric Nutrition. However, Adult nutrition did not get attention due to different circumstances. To overcome the challenges, the Ethiopian government formulated the Food and Nutrition Policy (FNP), which was endorsed by the Council of Ministers in November 2018. The goal of FNP is to enable the attainment of optimal nutritional status at all stages of life span and conditions to a level that is consistent with good health, quality of life, and productivity

(Tefera Belachew, 2019) strengthen health and nutrition clubs in the community. Moreover, studies also indicated that adults from low-income families were more exposed to metabolic syndrome (Sinaga M, *et al*.2018). The findings of this study showed that morbidity and mortality reports among adults had multifaceted forms requiring a multi-sectionalism approach (Horton S, *et al*.2013) mentioned in the National Nutrition Policy of 2013 to address it in (Chapters 3 and 4). Enforcement of the policies, strategies, and programs and a strong monitoring and evaluation system are needed.

For adults, weight management can be a major nutrition-related concern and a key factor in achieving health and wellness. To remain healthy, adults must be aware of changes in their energy needs, based on their level of physical activity, and then balance their calorie intake as needed. Adults who are active in sports or other physical activities may require more calories than less active adults (Ruel *et al*, 2013). It has been argued that government health-related objectives are best achieved when all sectors include health and well-being as a key component of their policy development, acknowledging that many influences of health and well-being lie outside the health sector (WHO & Government of South Australia, 2010).

The proportion of overweight/obesity among middle age was considerably high in Nekemte town. Being a female, high economic status, not having a healthy diet, and having a sedentary life were significantly associated with overweight/obesity. Globally, overweight is rapidly becoming one of the most important medical and public health problems. Adolescent obesity is a multisystem problem with potentially devastating consequences that persist into elderly disease complications. The findings of this study can be used to guide the development of programs aimed at preventing overweight/obesity in Ethiopia by informing policymakers and other stakeholders about this emerging nutrition-related problem among adults (Chapter 4).

The findings of the current study demonstrated education intervention modifiable risk factors of metabolic syndrome were managed and the prevalence of metabolic syndrome showed reduction. Studies conducted in different countries confirmed lifestyle interventions have positive outcomes on metabolic parameters (Hutton B and Fergusson D, 2004; Ford ES, *et al.*, 2011) (Sub-chapter 5:1). The finding of this study showed community team leaders improve the retention of participants during the intervention period. Similar to our study, group-based healthy lifestyle

intervention delivered in rural and underserved communities is acceptable; improves retention of participants, and the effectiveness of the program (Maher, C.A, *et al*.2021).

The community-based healthy lifestyle intervention incorporated diet, physical activity, and behavior modification strategies. The goals set for lifestyle intervention were based on the recommendations of the (WHO, 2016). This study also showed that there was a significant improvement in healthy lifestyle adoption, reduction of the prevalence of metabolic syndrome, and improvement in quality of life among middle-aged adults in the intervention group. Some studies also revealed that community-based health and nutrition education had a significant role in improving metabolic syndrome and quality of life (Yamaoka K and Tango T, 2012; Mohamed SA, 2014; Muchiri JW, *et al*., 2016; Makrilakis K, *et al*., 2012, Kushner RF, *et al*., 2014 and Hekmatpou, *et al*.2013) (Chapter 5).

The feature characteristic of the present research was that all of the positive effects of the HPM intervention were sustained with the 6-month follow-up. This success of the HPM intervention may be related to useful theoretical mediator constructs like behavior-specific cognitions and affect. Similarly, Van Sluijs found positive effects of the HPM intervention on successful behavior changes at a 3 or 6-month follow-up (Berry T *et al*. 2008, Twisk JWR *et al*. 2004).

Besides that different studies compare the impact of face-to-face communication over mass media campaigns on the effect of non-communicable disease prevention. For example, Face-to-face interventions seem to be more effective, at least for the reduction of DBP levels, even though nurses also significantly improve self-management behavior through telephone interventions (McCant F, *et al*. 2005). Therefore, the findings of this study imply that in Ethiopia, the National Strategy for Improved Health and Nutrition which is developed to complement the existing health policy can be successfully achieved if it is implemented in the community settings through intensive community leaders' involvement and community participation.

6.2. STRENGTHS AND LIMITATIONS

In this research dissertation, we aimed to determine the prevalence rates of Metabolic Syndrome and its components according to different diagnostic criteria and cut-offs. All major findings were published. However, the findings of this study should be interpreted with the following

limitations. Due to the quasi-experimental nature of the study, the changes observed might have happened to secular changes or baseline differences. However, the study had captured data from the controls at all waves of the data collection and comparison of the intervention and control groups does not substantiate this assumption.

There might be recall bias. However, we tried to minimize recall bias at the onset by training data collectors on how to probe adults to support them in remembering their practices. Although this study has a significant input for researchers and policymakers, there is a limitation as this study did not include early adults and those above the age of sixty-five. Therefore, there is a need for further study on how to use intensive community participation as an educational intervention tool or medium for improving healthy lifestyle adoption reducing metabolic risk factors and metabolic syndrome, and improving health-related quality of life.

6.3. CONCLUSIONS

In developing countries, the double burden of malnutrition and poor lifestyle practices are major barriers to adults' health. There are several pathways for this link between metabolic syndrome, unhealthy lifestyle, and poor quality of life. Middle-aged adults are at their critical period which determines their current and future health. Educational intervention based on the planned behavior theory of healthy lifestyle behaviors increased in intervention adults after educational interventions. Community leaders-based education had a significant effect on reducing the risk and distribution of metabolic syndrome and improving their lifestyles and quality of life. When they are equipped with health-promoting skills at this stage, they are more likely to adopt and sustain these behaviors throughout their lifetime and reduce complications.

To sum up the key issues, the following conclusions are drawn based on the findings:

- The overall magnitude of undiagnosed metabolic syndrome, diabetes mellitus, and poor health-related quality of life were relatively high among middle-aged adults in Nekemte, west Ethiopia.

- The prevalence of overweight and obesity among adults in West Ethiopia is considerably high compared to previous studies and it was significantly associated with sex, education, higher household economic status, and lifestyle.

- Metabolic syndrome has a significant association with poor health-related quality of life. Unhealthy lifestyle practices were significantly associated with household economic status, adult education, metabolic syndrome, and quality of life. Therefore, there is a need for multi-sectoral efforts to improve healthy lifestyle adoption to tackle metabolic syndrome and associated non-communicable diseases like diabetes, hypertension, and adults poor quality of life.

- Poor lifestyle has a significant contribution to adults' morbidity and mortality. Moreover, females, aged 41-48 years, income and attending lifestyle-related health education have a significant association with adult health.
- This finding can help policymakers improve their planning to promote the HRQoL of individuals with MetS as a whole in western Ethiopia.
- Integration of lifestyle education intervention into health extension activity and community health workers has a significant effect in improving the lifestyles of adults. Generally, the results of this study demonstrated that community-based healthy lifestyle education programs through community leaders' involvement can bring a significant difference in the healthy lifestyle practices of adults.
- The lifestyle educational intervention based on the stages of change model led to the promotion of physical activity levels in middle-aged adults in Nekemte Town.
- Theory-guided healthy lifestyle education brought through community-leaders involvement improved healthy lifestyle adoptions and health-related quality of life in mid-adulthoods. The intensive participation of community leaders in teamwork is essential for healthy lifestyle adoption and lifestyle disease prevention.
- The findings supported which argument that there would be a positive relationship between leadership and intervention performance. Though healthy lifestyle promotion is essential, alone might not be sufficiently secure, so upstreams of health determinants need health policy briefing to tackle the mortality and burden of unhealthy lifestyles.
- Community participation on theory-based healthy lifestyle education has significant positive metabolic effects that should be considered for future interventions.
- Healthy lifestyles cannot be theorized as suddenly arising in adulthood but instead has roots in early-stage social experiences and health behaviors. Adolescent health lifestyles are strongly patterned by attributed socioeconomic characteristics, suggesting that early

experiences shape health lifestyles. In turn, adolescent health lifestyles are related to early and late young adult health lifestyles. This study finds utility in a path dependency perspective, particularly in its articulation of early contexts and factors setting in motion behavioral patterns. Lifestyles are fairly dissimilar across life cycles, supporting developmental specificity. The result suggests that life-course changes in adulthood have the potential to convey inequalities in healthy lifestyles and to break the vicious cycle of health outcomes.

6.4. IMPLICATIONS OF THE FINDINGS

This PhD research generated evidence on the effect of healthy lifestyle education through intensive community leaders and theory-based interventions model on the lifestyles adoption, metabolic syndrome distribution, and quality of life of adults to make an advocacy case for healthy lifestyle programming and consolidation community-based healthy lifestyle adoption programs and early detection campaign of non-communicable diseases like diabetes, hypertension, obesity, dyslipidemia and their risks in Ethiopia.

Nowadays, the association between age and types of diabetes is confusing in the world. Knowing which age group is the peak for the onset of diabetes is novel and relevant special for East Africa and the World Health Organization to manage by region. This should change diabetes screening programs in the policy setting in low-income countries like Ethiopia. This finding implies that it is suggested better to start screening following nearly mid-life expectancy [≥30 years] in Ethiopia meaning following the age of 30, since the age of 50 and above comes with end-line diseases like kidney failure, vision impairments, in general macro and microvascular diseases. The findings of this study supported that which age groups of adults are at risk for diabetes and start screening needs attention in urban western Ethiopia.

The finding also identified intensive community leader participation as effective because they are members of the community. The role of a community leader is not to fix the whole community's problems but rather to work together with the community members. Community leaders mobilize and guide others, facilitate the problem-solving and decision-making processes, and innovate to benefit the community itself. And mostly reflected in those common qualities: integrating, courage, commitment, caring for others, creativity, and flexibility (Community Leadership Toolbox, 2021). Community leadership helps develop and nurture grassroots

innovations that improve the quality of life of the community members through active engagement toward common goals (Martiskainen M, 2017). Evidence shows that community leaders effectively support, foster, and enable community development (Kirk & Shutte, 2004, Martiskainen, M. 2017).

The results of this study bring valuable insights for the further development of healthy lifestyles education. Financial reasons and the lack of available time were the main determinants for people to engage in a healthy diet and physical activity. The government needs to undertake food insecurity. Increasing the availability of affordable and accessible healthy foods like polyunsaturated fatty acid oil, fruits & vegetables, and opportunities for physical activities in communities are essential for healthy lifestyles. Another bottleneck is the lack of community health care workers that give awareness on the effect of healthy lifestyles education on metabolic syndrome and quality of life. Due to the lack of health and nutrition information desks in all institutes, people also have limited knowledge of early screening, prevention, and self-management of NCDs.

The identified barriers are indicators for policymakers to plan, design, and implement healthy lifestyle adoption into the chronic care setting and redesign the existing health policy. Besides that, training of health care workers on healthy lifestyle adoption, physical exercise prescription, and metabolic syndrome prevention at all levels of medical education is required. Additionally, establishing communal training and a therapy center will be needed.

Multimodal behavioral intervention, including education, and medical nutrition therapy (diet, social, physio, and psycho) needs attention to NCD prevention. The nutrition lens approach is required to remove the barriers and use opportunities for healthy lifestyle adoption. Whatever active screening is recommended for all individuals above 40 years, this scenario needs a paradigm shift to be mid-off life expectance (above 30 years and 20 years for those of their family who have a history of NCDs). Our people do not visit health institutes to detect NCD risks early; so, community mobilization and motivation are suggested.

Ethiopia's current health care system placement of health facility structures and staffing is not established NCD clinic with a team of experts, except the specialized hospitals. So, it is strongly recommended to integrate healthy lifestyle education into the health post for primary prevention

of NCD through health extension workers under the supervision of health officers or practitioner nurses, delivering NCD services at ART clinics, chronic care/referral clinics, and specialized clinic in the health center, general hospital and tertiary hospital respectively. To be effective in healthy lifestyles adoption and chronic noncommunicable disease care, Ethiopia should take the social capital perspective into account and implement a primary prevention plan using health care workers.

In general, this community leaders-based healthy lifestyle education improved healthy lifestyle adoption and anthropometric measures among the intervention group compared to the control one. Additionally, leading the intervention through community leaders' prominent tool for implantation of education; improved team leader effort and adults satisfaction. The finding implies theory-based educational intervention through intensive community-based team leadership should have a more positive effect on the implementation of educational intervention, healthy lifestyle adoption, team performance, and satisfaction. In short, the findings imply the need for targeting community participation with intensive community leaders' engagement in designing healthy lifestyle education interventions.

6.5. RECOMMENDATIONS

- The high rates of metabolic syndrome and its components in the study point to a need for behavior change related to improved lifestyle through a holistic approach. This indicator calls for public health interventions to reduce the prevalence of metabolic syndrome among urban middle-aged adults in West Ethiopia to the entire country.
- Policymakers and other stakeholders should consider the impacts of unhealthy lifestyles on sustainable community health during the formulation of national Health and nutrition policies. Adapting and implementation of TPB-based intervention by health policymakers and healthcare providers are suggested to achieve a better perception of a healthy lifestyle among middle-aged adults.
- Developing effective public health strategies for the prevention, early detection, and treatment of metabolic syndrome should be an urgent priority to reduce the burden of NCDs that bring a tangible burden to healthcare systems.

- Design and develop policies targeting screening of MetS to prepare national advocacy and health information on health lifestyle programs that need attention at the population level.
- Age-targeted community-based education on early detection and prevention of diabetes, as well as its complications, is significant to saving adult lives.
- Early detection of metabolic syndrome factors is likely to reduce not only its incidence in adulthood, but it could also significantly reduce the prevalence of this condition and its late complications in the late adult and elderly populations.
- This finding demonstrated that lifestyle educational programs through community-leaders involvement in community participation can bring a significant difference in healthy lifestyle adoptions of adults suggesting that the intervention achieves on reduction of metabolic syndrome prevalence, improvement of healthy lifestyle practices, and quality of life among middle-age. Therefore, lifestyle education through community involvement and managing the program through community participation should be a part of comprehensive community health programs to reach adults.
- It is recommended to develop educational programs based on the stages of change model to increase the physical activities of middle-aged adults.
- Innovative funding tools, multi-sectoral supremacy, community engagement, and an integrated service delivery approach mainly using primary health care are required to achieve desired goals.
- Since the chance of developing degenerative diseases like heart disease, and hypertension declines by early managing the risk factors of metabolic syndrome, early screening of metabolic syndrome should be recommended to prevent the occurrence of chronic diseases.
- There is a need for proper healthy lifestyle educational intervention through the framework of community leaders' engagement with the adults for the improvement of lifestyle behaviors of middle-aged and to reach the entire population.

6.6. FUTURE RESEARCH PERSPECTIVES

In developing countries, the relatively lower rate of mortality, compared to their younger counterparts, led to the misconception that adults are healthy and practice healthy lifestyles. However, studies found that a large number of middle-aged in low-income countries are affected

by several health issues such as non-communicable diseases and chronic energy deficiency, and die at their productive age. This study tried to search the sun-clinical prevalence of metabolic syndrome, diabetes, and health-related quality of life and the effect of lifestyle education in preventing them. However, the following points should be further considered to strengthen and intervene to tackle lifestyle-related problems among adults:

- The study could be replicated in other urban areas in Ethiopia, and a comparison made with the current study to establish if the problem of metabolic syndrome is widespread and not a unique problem to Nekemte, the hub for Towns of western Ethiopia. This would help in establishing the major factors contributing to metabolic syndrome among middle age in these other areas to break down the vicious cycle of these degenerative diseases.
- Further study should be done by including adults aged from 18-40 years to identify appropriate intervention strategies and further to strengthen adult nutrition, and health and promote healthy lifestyle education.
- This conceptual model of community-based leadership is appropriate for establishing a standardized community leadership curriculum at the national level in the context of Ethiopia. Orienting health systems through people-centered health care and universal health coverage is an example.
- The study should be done by considering socio-cultural factors like intra-household food distribution to design appropriate intervention strategies.
- Health professionals should be prompted to recognize subjects at high risk for cardiovascular disease attending the primary prevention healthcare system, by taking into consideration not only classical cardiovascular risk factors but also the socioeconomic and educational characteristics of each individual.
- As middle age is a transitional phase to chronic noncommunicable diseases, this could be further exacerbated by chronological aging and complications of end-line diseases. So, further study should consider the other extreme burden of malnutrition and measure the dietary adequacy of middle-aged adults.
- Strategies targeting the Ethiopian adult demographic to promote a healthier lifestyle should be encouraged.

- The community leaders-led, health promotion model-guided lifestyle education was convenient for clinical application and should be incorporated into routine practice for patients with metabolic syndrome.
- Unhealthy lifestyle, metabolic syndrome, complications of NCDs, and poor quality of life are indivisible. The findings indicated that lifestyle intervention effectively improved self-efficacy and health-promoting behaviors for adults with metabolic syndrome. Thus, a study on the effect of healthy lifestyle education interventions in middle-aged adults in Nekemte Town could be useful to establish if people generally consider it a problem in Ethiopia.

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ANNEXES

I. CURRICULUM VITEA		
Full Name	**ALEMU ADEBA FEYISSA**	
Equivalent address	Jimma University, Jimma, Ethiopia	
Institution	Wallaga Univeristy, Nekemte, Oromia, Ethiopia	
Contact address	alemuadeba7@gmail.com, ORCID_iD 0000-0002-4384-9827, linkedin.com/Alemu Adeba, +251911275645, +251921839090	
Gender	Male	
Nationality	Ethiopian	
Date of Birth	September 24, 1984 (1/14/1976 E.C)	
Civil Status	Married	
Religion	Protestant Christian	

Education and Qualifications

On: February 8, 2024

PhD in Human Nutrition, Jimma University, Ethiopia.

June 26, 2013

MSc. in Nutrition and Food Science, Wollega University , Ethiopia

September 15, 2010

BED in HOMA , Hawassa University, Ethiopia

July 20, 2016

BSc in Public Health, New Generation University, Ethiopia

July 13, 2005

Advanced Diploma in **Food Technology**, Bahir Dar University, Ethiopia.

Work Experiences

2014-till present	serve as Lecturer and Researcher at Wallaga University
2011 to 2013	services as Dean of Nekemte polytechnic college
2008-2010	Instructor at Nekemte TVET College

Certifications/Training/Skill highlights

- ✓ **Policy briefing on Public health** from Nov. 7-11, 2017 at Jimma University, Ethiopia.

- ✓ **Generalized linear model analysis** from October 7-12, 2019 at Jimma University, Ethiopia.
- ✓ **Longitudinal data analysis using R-software** from January 16-20, 2017 at Jimma University, Ethiopia.
- ✓ **Advanced biostatistics training on descriptive statistics, ANOVA, logistic regression, linear regression, multinomial, ordinal and survival analysis and non-parametric test and longitudinal data analysis using STATA**from Nov. 7-11, 2017 at Jimma University, Ethiopia.
- ✓ **Exam Blue Print Development Workshop for Food and Nutritional Sciences program** Organized by Jhpiego Ethiopia with Funding from feed the future through United States Agency for International Development (USAID) growth through Nutrition Activity from June 3-30, 2020.
- ✓ "**Research Grant Writing** "Organized by Wallaga University from June 5-7, 2022.
- ✓ **Writing Scientific Research Methodology** Organized by Wallaga University from May 5-7, 2023.
- ✓ **"Manuscript preparation , Research Ethics and Publications"** Organized by Wallaga University from June 5-7, 2023

Languages:	Afan Oromo-**A1** , Amharic-A2 , English-A2 , French-A3
Research Interest	Population, Health & Nutrition, Healthy lifestyle, Diet and Diseases, Metabolic Syndrome, NCDs, Adult Health & Nutrition, Food Sciences, Child and Maternal Nutrition & health, Data analysis with different models

List of Publications

1. Adeba A, Dessalegn T, Tefera B. Theory-based lifestyle educational intervention through intensive community leaders' affects healthy lifestyles adoption of middle-aged Nekemte populations: A quasi-experimental control study. Medicine (Baltimore). 2023 Feb 3; 102(5):e31414. Doi: 10.1097/MD.0000000000031414. PMID: 36749258; PMCID: PMC9902019.
2. Adeba A, Tamiru D and Belachew T (2024) Healthy dietary practices and its' associated factors among adults of Nekemte dwellers, Oromia State, Western Ethiopia. *Front.*

Nutr. 10:1259024. doi: 10.3389/fnut.2023.1259024.

3. *Adeba, A., Tamiru, D., & Belachew, T. (2023). Healthy diet, prevalence and factors associated among adults of Nekemte dwellers, Oromia State, Western Ethiopia. Italian Journal of Medicine, 17(3). https://doi.org/10.4081/itjm.2023.1630.*
4. *Alemu Adeba*1, Dessalegn Tamiru1, Tefera Belachew1 (2022).* Effect of Educational Intervention on Modifiable Risk Factors of Metabolic Syndrome among Middle-Age Nekemte Populations: Quasi-Experimental Study**.** Systematic Reviews in Pharmacy 2022; 13(10): 968-974, multifaceted review journal in the field of pharmacy. N 0976-2779 P-ISSN 0975-8453 / DOI: 10.31858/0975-8453.13.10.968-974.
5. Alemu Adeba, Dessalegn Tamiru, Tefera Belachew. Magnitude and Associated Factors of Undiagnosed Diabetes Mellitus among Mid-Adulthood Urban Residents of West Ethiopia. *Ethiop Med J, 2022, Vol 60, No, 1.*
6. Alemu A, et al.: Metabolic Syndrome and its Association with Quality of Life among Middle Aged Urban Residents in West Ethiopia. Annals of Medical and Health Sciences Research | Volume 13 | Issue 8 |2023. DOI: 10.54608.annalsmedical.2023.119.
7. Alemu a Feyissa. "Magnitude of metabolic syndrome among middle age adulthood urban residents in west Ethiopia", Cambridge University Press (CUP), 2021. Crossref
8. Alemu Adeba*, Dessalegn Tamiru, Tefera Belachew. Which age group is peak for onset of diabetes among mid-adulthood urban population in West Ethiopia? African Journal of Diabetes Medicine; Vol 29 No 6 NOVEMBER 2021.
9. Alemu Adeba*, Dessalegn Tamiru, Tefera Belachew. Magnitude of Overweight, Obesity and Associated Factors among Middle Aged Urban Residents of West Ethiopia. Adeba et al. J Obes Weight-Loss Medic 2021, 7:041. Volume 7, DOI: 10.23937/2572-4010.1510041.
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11. Alemu Adeba*, Dessalegn Tamiru and Tefera Belachew (2021). Healthy Lifestyle Education effect on Health-Related Quality of Life among Middle-Aged Urban Residents of West Ethiopia: Quasi- Experimental Study. *Int J Med Res Health Sci 2021,*

10(8): 69-77.

12. Adeba, A., Tamiru, D., & Belachew, T. (2021). Barriers and Facilitators in Adopting Healthy Lifestyles in West Ethiopia: A Qualitative Research Study. Vol. 2 No. 1 (2021): Journal of Medical and Health Studies. https://doi.org/10.32996/jmhs.2021.2.1.3
13. Dessalegn Tamiru1, Alemu Adeba1* ,Tefera Belachew1, Rebecca Dewey2. Health-Related Quality of Life and Associated Factors among the Middle-Aged Urban Population in Western Ethiopia. IJMR ms#47957] Revision of ms 47957 received. 2024.
14. Alemu Adeba, Sileshi Garoma, Habtamu Fekadu, Wondu Garoma (2014). Prevalence of Wasting and Its Associated Factors of Children among 6-59 Months Age in Guto Gida District, Oromia Regional state, Ethiopia. **Journal of Food Processing & Technology , Volume 29, 2013.**DOI: 10.4172/2157-7110.1000289
15. Alemu Adeba, Sileshi Garoma, Habtamu Fekadu, Wondu Garoma (2014). Prevalence of Stunting and Its Associated Factors of Children among 6-59 Months Age in Guto Gida District, Oromia Regional state, Ethiopia. Food Science and Quality Management, Vol.29, 2014. www.iiste.org
16. Alemu Adeba [1], Sileshi Garoma [2], Habtamu Fekadu [2a], Wondu Garoma [2]. Prevalence of Undernourishment and its Associated Factors of Children among 6-59 Months Age in Guto Gida District, East Wollega Zone, Oromia, Ethiopia. Scientia Research Library ISSN 2348-0416. USA CODEN: JASRHB. Journal of Applied Science and Research, 2014, 2 (1):50-72.
17. Alemu Adeba*, Dessalegn Tamiru and Tefera Belachew (2023). A Systematic Scoping Review of Policies Linked to Early-Life Lifestyle and the Risk of Adulthood Metabolic Diseases in Ethiopia: Is it a lack of policy or Implementation Gap? Paper number: R11214. ISSN: 19650256 (E) 12674982 (P)

References

- Professor, Dr. Tefera_Belachew (MD, MSc, PhD), Jimma University. Tel; +251917804072, E-mail; teferabelachew@gmail.com
- Dr. Dessalegn Tamiru (PhD, Asso.prof.) Jimma University. Tel; +251912373397, E-mail; dessalegn97@gmail.com

✍ Dr. Silashi Garoma (PhD, Asso.prof.), Ministry of Health, AA. Tel +251911076012 ✍ Prof. Kalkidan Hassen(PhD), JU, Tel; +251911370862,,-mail:newew333@gmail.com ✍ Dr. Habtamu Fekadu(PhD), Wollega University, Nekemte. Tel +251911076012 ✍ Dr. Wondu Garuma (PhD), Wollega University, Nekemte. Tel +251911715806 ✍ Dr. Dessalegn Wirtu (PhD), Wollega University, Nekemte. Tel +251911180221 ✍ DR.Getachew Jelkeba(MD, Specialist in Ophthalmologist), Nekemte Referral Hosital, Tel +251915928714	
Hobbies	✍ Public relations, Team sports , reading

II. ETHICAL APPROVAL LETTER

JIMMA UNIVERSITY
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Ref.No IHRPGD/596/2019
Date 1/01/2019

Institutional Review Board (IRB)
Institute of Health
Jimma University
Tel: +251471120945
E-mail: zeleke.mekonnen@ju.edu.et

To: Alemu Adeba

Subject: Ethical approval of research protocol

The IRB of institute of health has reviewed your research project entitled:

"Effect of healthy lifestyle education on modifiable risk factors of metabolic syndrome and health related quality of life among adult in Nekemte city, Western Ethiopia"

This is to notify that this research protocol as presented to the IRB meets the ethical and scientific standards outlined in national and international guidelines. Hence, we are pleased to inform you that your protocol is ethically cleared.

We strongly recommended that any significant deviation from the methodological details indicated in the approved protocol must be communicated to the IRB before they are implemented.

With regards!

Zeleke Mekonnen (PhD)
Associate Professor, Health
Research and Postgraduate
Director

Tel. +251-47 11 114 57
PBX: +251471111458-60
Fax: +2514711114 50
+251471112040
P.O.Box. 378
JIMMA, ETHIOPIA
e_mail: ero@ju.edu.et
website: http://www.ju.edu.et

III. SUPPORTIVE LETTER NEKEMTE HEALTH OFFICE

Bulchiinsa Naannoo Magaala Naqamteetti
Waajjira Eegumsa Fayyaa Naqamtee

Lakk 1173/ ... /2011

Guyyaa 27/08/2011

Waajjira/Ku.Bulchiinsa B/Saantoo Galalaajii tiif

Naqamtee

Dimmi isaa :- deggersa kennuu ta'a.

Akkuma armaan olitti ibsame Yuuniversiitii Jimmaa irraa xalayaa lakk. 563/2011 guyyaa gaafa 23/04/2011 barreesseen Obbo Alamuu Adibba Qorannoo isaanii mata duree "***Health life styles education on modifiable risk factors and health related quality of life among adult in Nekemte city, Western Ethiopia***" jedhu irratti kutaa Bulchiinsaa keessan keessatti qorannoo isaanii gaggeessuu waan barbaadaniif deggersa akka barreessinuuf nugaafataniiru.

Kanaafuu karaa keessan deggersa barbaachisaa ta'e akka gootaniif isni gaafanna.

Nagaa wajjin!

Indaalee Taammiruu Birrisaa
Endale Tamiru Birisa
R/H/Humna Namaa fi Leenjii

G/G

- Obbo Alamuu Adibbatiif
  B/J

IV. PARTICIPANT'S CONSENT INFORMATION SHEET

Project Title: effect of healthy lifestyle education on modifiable risk factors of metabolic syndrome and health-related quality of life among adults in Nekemte Town.

JIMMA UNIVERSITY, SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF NUTRITION AND DIETETICS

My name is _____from Jimma University. The purpose of this study is to assess effect of healthy lifestyles Education on modifiable risk factors of metabolic syndrome and Health related quality of life to improve adult health, physical activity, and dietary practice. Your participation is important for the success of this research, besides the findings of this research will help further studies in this area. You are selected randomly to participate in this study.

If you agree to participate in the study:

- We will measure your nutritional status and ask you some questions concerning about your dietary intake.

Risks or discomforts: You will not be exposed to any risks for participating in this study.

Benefits: If you agree to participate in the study you will be told your nutritional status. It can also provide baseline data for policy makers and other researchers.

Confidentiality: Your name will not be written in this form and all information given by you will be kept confidentially.

Participation: Your participation is voluntary and you are not obliged to answer any question you don't want to answer. If you fill discomfort, you are free to drop at any time you want.

You can ask any unclear questions

Are all questions clear? a) Yes b) No

Are you willing to participate in this study? a) Yes b) No

(1) If yes, I will continue and 2) if no I will skip to next participant after writing the reasons of refusal.

Interview code_____ Signature_____

Date of interview_____ Starting time_____ completed_____

Result of interview 1) completed 2) not completed 3) partially completed 4) refused

Checked by supervisor: Name _____Sig._____

Thank you for your cooperation!

V. QUESTIONNAIRES – ENGLISH VERSION

English Version Questionnaire			
Jimma University, Department of Nutrition and Dietetics ID. No. _____Adult's full name/CODE_____			
PART I. Socio-economic and demographic characteristics of the participants			
S.No	Questions	**Probe &mark all answer**	Remark
1.	Name of Commune/Ganda	_____	
2.	Sex	1.Male 2.Female	
3.	Age	1.41-48 2.49-56 3.57-64	
4.	Your educational status?	1.Unable to read&write 2.Some school 3.Diploma 4.Degree & above	
5.	Your Marital status?	1. Single 3. widowed 2.married 4.devorced	
6.	What is your religion?	1.protestant 3.musilm 2.orthodox 4.Wakefata 5.Others	
7.	What is your Ethnicity?	1.Oromo 3.Tigrie 2. Amhara 4. Others	
8.	What is your occupation & characteristics?	1.Jobless 3.sitting work 2.light work 4.Stund>4hrs	

9.	How much is your family estimated average monthly income/person?	1.Less than $37.5 2.>$75-100 4.>$100	
10.	Do you have home gardening /urban farming?	Yes 2. No	
11.	Do you have health insurance?	1. Yes 2. No	
12.	Wealth Quintiles/index	1. Poorest 2. poor 3. Middle 4. Rich 5. Richest	

PART II. **Questionnaire for: assessing dietary diversity /healthy nutrition /FFQ.**

S/n	Questions	Responses	Remark
13.	Cereals: corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + injera, Pourage,	1 Daily 2. Twice weekly 3. Three times weekly 4. Rare/occationally 5.Never	
14.	Legumes, pulse and nuts. Like: Peas, Bean, soybean, Nuts, sesame, Niger seed ,lancets, etc	1 Daily 2. Twice weekly 3. Three times weekly 4. Rare/occationally 5.Never	
15.	White Tuber and roots : white potatoes, white yam, white cassava, or other foods made from roots	1 Daily 2. Twice weekly 3. Three times weekly	

		4. Rare/occationally 5.Never	
16.	Vegetables: -pumpkin, carrot, squash, or sweet potato that are orange inside , red sweet pepper, dark green leafy vegetables,(including wild forms + locally available vitamin A rich leaves such as amaranth, cassava leaves, kale, spinach) -other vegetables (e.g. tomato, onion, eggplant)	1 Daily 2. Twice weekly 3. Three times weekly 4. Rare/occationally 5.Never	
17.	Fruits: ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these.	1 Daily 2. Twice weekly 3. Three times weekly 4. Rare/occationally 5.Never	
18.	Meat and its products: Liver, kidney, heart or other organ meats or blood-based foods, beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects.	1 Daily 2. Twice weekly 3. Three times weekly 4. Rare/occationally 5.Never	
19.	Milk and its products: milk, cheese, yogurt or other milk products	1 Daily 2. Twice weekly 3. Three times weekly 4. Rare/occationally 5.Never	

20.	Eggs from chicken, duck, guinea fowl or any other egg	1 Daily 2. Twice weekly 3. Three times weekly 4. Rare/occationally 5.Never	
21.	Fishes and other seafood's: fresh or dried fish or shellfish	1 Daily 2. Twice weekly 3. Three times weekly 4. Rare/occationally 5.Never	
22.	Legumes, nuts, and seeds: dried beans, dried peas, lentils, nuts, seeds or foods made from these (eg. hummus, peanut butter)	1 Daily 2. Twice weekly 3. Three times weekly 4. Rare/occationally 5.Never	
23.	Fats and oils: oil, fats or butter added to food or used for cooking	1.Animal butter regularly 2. Clotted oil always 3. Purified oil always 4. Mixed of butter & oil	
24.	Sweets: sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes/junk foods like sandwiches/burger	1. Yes daily consumption 2. Twice a week 3. Once a week	

		4. Once a month	
25.	Spices, condiments and beverages: spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages	1.Yes daily consumption 2. Twice a week 3. Once a week 4. Once a month	

PART III. History of physical activity

S/n	Question	Responses	Remark
26.	Have you ever engaged in physical activity?	1. Yes 2. No	
27.	Do you practice aerobic exercises?	1. Yes 2. No 3.Yes, but partially	
28.	Which typical physical activity do you practice regularly?	1.Walking 2.Running 3.Stairclimbing 4.Cycling 5.Rowing 6.Swimming 7.Cross-countryskiing	
29.	Do you do muscle strength physical activity?	1. Yes 2. No	
30.	For how long physical activities do you do day/week, minutes/day respectively?	1.>3day/wk, &150m'/wk 2.3dys/wk,&120-150m'/wk 3.<3dys/wk,&120M'/wk 4. Never engage in	
31.	Do you gardening/urban farming activity?	1. Yes 2. No	

32.	Do you practice occupational physical activity (at least 4 hours per work day in a non sitting activity)		1. Yes 2. No	
33.	Non occupational physical activity (at least 1.5 hours per week)		1. Yes 2. No	
34.	Participation in physical/sport club		1. Yes 2. No	
35.	Do you engage in very light activity?	Room painting, pushing a wheelchair, yard work, ironing, cooking, and playing a musical instrument.	1. Yes 2. No	
36.	Do you engage in light activity?	Slow walking (24 min/mile), garage work, carpentry, house cleaning, child care, golf, sailing, and recreational table tennis	1. Yes 2. No	
37.	Do you engage in moderate activity	walking a15-minute mile, weeding and hoeing a garden, carrying a load, cycling, skiing, tennis, and dancing	1. Yes 2. No	
38.	Do you engage in high activity?	Jogging a mile in 10 minutes, walking with a load uphill, tree felling, heavy manual digging, basketball, climbing, and soccer	1. Yes 2. No	
39.	Do you engage in others may be?	Flexibility exercises attain full range of joint motion, strength or resistance exercises, and aerobic conditioning	1. Yes 2. No	

PART IV. Health Related Quality Of Life (EQ_5D index score) status

	Questions		Response	
40.	Do you know Health related quality of life?		1.Yes 2.No	
41.	Willingness to acquire health-related quality of life knowledge?		1. Yes 2.No 3. yes, but little	
42.	Physical health	Do you feel less energy or fatigue?	1.Yes 2.No	
		Do you feel Pain and discomfort always?	1.Yes 2.No	
		Do you have any Sleep disorders?	1.Yes 2.No	
		Do you have any one of co morbidity?	1.Yes 2.No	
43.	Psychological health	Do you have any cognitive thinking problem?	1.Yes 2.No	
		Do you have Anxiety or depression?	1.Yes 2.No	
		Is your life at normal utility index?	1.Yes 2.No	
44.	Level of independence	Feel free in mobility	1.Yes 2.No	
		Usual/daily activities practice or have capacity?	1.Yes 2.No 3.Yes, but partially	
		Are you drug or medical aids dependent?	1.Yes 2.No 3.Yes, but partially	
		Do you have health insurance?	1.Yes 2.No	
45.	Is your Social relationship normal?		1.Yes 2.No	

46.	Environment	Housing quality	1. Standard 3. Rent 2.Local 4.Homeless	
		Water quality	1. Line water as standard 2. line water, but partially 3. protected spring 4. Run or river water	
		Do you have adequate recreational area?	1.Yes 2.No	
		Lack of transport	1.Yes 2.No	
		Do you have access and quality of health &Social care?	1.Yes 2.No 3. Yes, but partially	
		Lack of healthy physical environment?	1.Yes 2.No	
		Financial resources	1. Wealthy 2. Normal 3. Below standard	
47.	Values &beliefs	Are you spirituality strong?	1.Yes 2.No	
		Do you have Personal belief?	1.Yes 2.No	

PART V. History of healthy Lifestyle status from self-report			
48.	Smoking	1.Yes 2.No	
49.	Alcohol consumption	1.Yes 2.No	
50.	Chat Chewing	1.Yes 2.No	
51.	Sedentary life	1.Yes 2.No	

52.	Practicing unhealthy diet	1.Yes 2.No	
53.	Did you intakes excess added sugar?	1.Yes 2.No	
54.	Did you use excess saturated (clotted oil) fats?	1.Yes 2.No	
55.	Did you use excess salt?	1.Yes 2.No	
56.	Daily fruit and vegetable consumption (at least 5 services per day)	1.Yes 2.No	
57.	Television viewing time (less than 2 hours/day)	1. Yes 2. No	
58.	Did you have sleep deprivation?	1. Yes 2. No	

PART V. Risk factors of metabolic syndrome and related health conditions

59.	Have you checked ever before for any health problem?	1.Yes 2.No	
60.	Have you checked for your nutritional status?	1.Normal 2.Underweight 3.Overweight 4.Obese	
61.	Have you checked for your Obesity status, If yes?	1.Moderate>30.34.9BMI 2.Severe>35-39.9BMI 3.Very severe>40BMI	
62.	Do you have known Diabetes mellitus?	1.Yes 2.No	
63.	Do you have known HBP/ Hypertension?	1.Yes 2.No	
64.	Do you have known Heart failure?	1.Yes 2.No	
65.	Do you have known stroke?	1.Yes 2.No	
66.	Do you have Osteoarthritis/Arthritis?	1.Yes 2.No	

67.	Do you have breathing problem?		1.Yes 2.No	
68.	Do you have Chronic Cough/COPD?		1.Yes 2.No	
69.	Do you have Constipation?		1.Yes 2.No	
70.	Is your appetite increases or loss?		1.Yes 2.No	
71.	Have you checked for Dyslipidemia?		1.Yes 2.No	
72.	How much liters of water do you drink/day?		_____	
PART.VI: Anthropometry measurements				
73.	Weight in Kilograms		_____	
74.	Height in centimeters		_____	
75.	Waist circumference in cm		_____	
76.	Hip circumference in cm		_____	
77.	Waist to hip circumference ratio		_____	
78.	Blood pressure =S/D	Systolic in mmHg	_____	
		Diastolic in mmHg	_____	
Part VII. Biomarker measures				
79.	Fasting plasma glucose level			
80.	Imparied FBS	Normal range		
		Pre diabetes		
		Diabetes		
81.	Estimated average glucose level/HbA1c			
82.	Lipid profiles	Total triglyceride(TG)		
		HDL-C		

		LDL-C		
Qualitative: Guide Questions /Focus Group Discussion guide line for assessing healthy lifestyle Adoption.				
Socio-demographic	Age group	1)41-48, 2)49-56, 3)57-64 years		
	Sex	1.Male 2.Female		
	Occupation	_____		
Domain 1	**Dietary habit**	1. What kind of food do you and your family usually eat? **Probe**: What type of foods do you and your family usually eat? How often? Why do you and your family eat such foods		
		2. How do you and your family take oil/salt? **Probe**: How much oil/salt do you and your family consume? Do you think the amount of oil/salt you and your family consume is excessive? If yes, what are the main difficulties for reducing the amount of oil/salt?		
		3. Do you and your family take snack? **Probe:** What type of snack do you and your family eat? How often? Why do you and your family eating such snacks?		
		4. Do you and your family often eat in the restaurant? **Probe:** How often do you and your family eat in the restaurant? On what kind of occasions do you and your family eating outside?		
Domain2	**Regular exercises**	1. How do you assess the physical activity level of you and your family, including at home or in the workplace? **Probe:** What types of physical activities do you and your family like? How often? Is your job physically demanding?		
		2. Do you and your family have the habit for regular physical activity? **Probe:** If you and your family are engaging in regular physical activities, what are the main reasons? If you and your family are not engaging in any physical activity, what are the main reasons?		
Domain 3.	**Tobacco smoking**	1. Do you and your family smoking/drinking alcohol? **Probe:** What types of cigarette/alcohol do you consume? How often? On what kind of occasions do		

	and alcohol drinking	you and your family smoking/drinking?	
		2. Do you know the health consequences of smoking/drinking alcohol? **Probe**: What are the main difficulties of quit smoking/drinking alcohol? Do you feel any influence/pressure from family or community on your smoking/drinking behavior?	
		3.The probe "Do you use tobacco? If "yes", do have a plan to stop? Which coping strategy do you apply?" We categorized participants' strategies they implement to stop based on raised questions for participants (reduced consumption, solely price-minimizing behaviors, and no strategies to reduce spending).	
Domain 4.	**Health seeking behaviors**	1. Will you and your family seek medical care when feel sick? **Probe:** Where will you and your family seek medical care when feel sick? What the main reasons are for seek medical care there?	
		2. Do you and your family take health checkup regularly? **Probe**: If yes, how often do you and your family go for health check-up? What are the main reasons? If no, what are the main reasons of not going for health check-up?	
		3. Do you have dedicated clinical guidelines and protocols for risk screening?	
		4. Do you believe that your healthy lifestyles need advice from your primary care physicians? **Probe**: If yes, how often do you and your family practices in healthy lifestyles? What is the attitude toward its application? If no, what are the main reasons of not practicing and going for metabolic risk factors check-up?	
Domain 5.	**Awareness and expectations towards**	1. What do you know about NCDs (hypertension, T2DM, etc.)? **Probe:** What are the symptoms/health consequences of NCDs (hypertension, etc.)? Do you know the causes of NCDs (hypertension, etc.) and how to prevent? What are the main information sources of you to acquire health knowledge about NCDs?	

	NCD prevention	2. What do you think about current prevention programs and treatment services of the community /nation level? **Probe**: Do you satisfy with those programs and treatment services? What do you expect in the future program of community/nation level?	
		3. Do you think that is there sufficient information technology infrastructure and tools for community to prevent NCD?	

Household Wealth

***Now I will ask you about some fixed assets that your household have*.**

	Does the household have any of the following properties? **(Circle)**	**Yes**	**No**
1	Functioning radio/Tape recorder/CD player	1	0
2	Functioning Television	1	0
3	Gas Stove	1	0
4	Kerosene stove	1	0
5	Electric stove	1	0
6	Bicycle	1	0
7	Motor Cycle	1	0
8	Cart/Gari	1	0
9	Watch (Hand/Wall)	1	0
10	Mobile phone	1	0
11	Plough	1	0
13	Sofa	1	0
14	Spring mattress	1	0
15	Sponge/Foam mattress	1	0
16	Cotton mattress	1	0
17	Grass Mattress	1	0
18	Chair/Stool	1	0
19	Generator	1	0
20	Milling	1	0
21	Water pump	1	0
	Does the household have any of the following animals?	1.Yes 0. No	How many?
22	Oxen		
23	Cows		
24	Horse/mules		
25	Goats/Sheep		
26	Chickens		
27	Donkey		
28	Pig		
	THANKS		

VI. WARAQAA ODEEFFANNOO HAYYAMA HIRMAATAA

GAAFFILLEE QORANNOO

YUUNIVERSIITII JIMMAA

FAKALITII FAYYAA HAWWAASAA

MUUMME SOORATAA FI DIYITEETIKSII

QORANNOO WALIINII

DHIIBBAA BARNOOTNI AKKAATAA JIREENYAA FAYYAA QABNOOTA BALAA FOOYYA'UU DANDA'AN SINDIROOMII MEETAABOLII FI QULQULLUMMAA JIREENYAA FAYYAAN WALQABATE MAGAALAA NEKEMTE UMURII GIDDUGALEESSAA IRRATTI FIDU.

Ashamaa: Maqaan koo _____ jedhamaa. Ani odeeffannoo isinirraa argachuuf dhaabata Yuniverstii Jimmaa irraa « **Dhiibbaa Giddu-galeessi Barnoota Akkaataa Jireenya Fayyaa Umurii giddu galeessaa Magaalaa Nekemte »** jedhu irratti gaaffilee tokko tokko ofii keessan akkamitti akka soortattanii fi jiraatta isin gaafachuufan jedha. Hirmaannan keessan qorannoo kun akka fiixaan ba'uuf ga'ee gudda qaba. Umuriin keessan waan isin kadhimateef qorannoo kanatti hirmaachuuf filatamtaniittu.

Yoo hirmaachuuf fedha qabaattan

- Haalli fayyaa keessanii nyaataan wal-qabatee maal akka fakkaatu ni sakkatta'ama.
- Akkasumas akkaataa itti sooraa jirtanii fi nyaata maalii akka sooraa jirtan ni gaafatamtu.
- Dhibee miti-dadarbootiin wal-qabatee ni sakkatta'amtu.

Rakkoo fi haala hin mijoofne: Balaan ykn rakkinni tokkollee isinirra hin ga'u.

Bu'aa qorannoo: Yoo qorannoo kanatti hirmattan akkaataa jireenya fi fayyaa keessan akka eeggatan ni barattu. Rakkoolee gama kanaan wal qabatanii jiran furuufis ni gargaara, akkasumasille warra imaammata fayyaa baasaniif akka madda odeeffannootti ni gargaara.

Eeggannoo fi to'annaa godhamu: Odeeffannoon isin laattan Kun eenyufiyyuu bifa kamiinuu hin kennamu.

Hirmaannaa: Yeroo barbaaddanittis addaan kutuu ni dandeessu, dirqamni hin jiru. Gaaffii fi deebiin kunis sa'atii tokko fudhachuu danda'a.

Gaaffilee isiniif hin galle gaafachuu dandeessu

Gaaffiin hundumtu ifaa? a) eyyee b)lakki

Hirmaachuuf fedha qabduu? a) eyyee b)lakki

Naa eyyamtaniittuu ittifufuudhaaf?

(1) Yoo naa eeyyamamee ittan fufa (2) kanaa achi gara nama biraattan darba

Koodii gaaffii_____ mallattoo_____

Guyyaa _____sa'aatii itti jalqabame_____fi xumurame_____

Firii gaaffii fi deebii

1) Xumurameera 2) Hin xumuramne 3) Walakkeefameera 4) Hin hafe

Suppervayizeeriidhaan raggasifameera: Maqaa_____Mallattoo_____

Gaaffii fi deebii Afaan Oromootti Hiikame			
Yuniversiitii Jimmaatti, Muummee Sooratаа fi Diteetiksii			
Lakk. Kooddii. _____Maqaa Guutuu/kooddii_____			
Garii I. Amaloota hawaas-dinagdee fi dimogiraafii hirmaattotaa			
Lakk.	Gaaffilee	**Deebii kee kan ta'e hunda qoradhu / filadhu**	yaada
83.	Maqaa Ganda sanaa	_____	
84.	Saala	1.Dhiira 2.Dhalaa	
85.	Umuruu ga'eessa sanaa	1.41-48 2.49-56 3.57-64	
86.	Haala barnootaa keessanii?	1.Barreessuu fi dubbisuu hin danda'ani 2.Qalama 3.Diploma 4.≥Digrii jalqabaa	
87.	Haala Gaa'elaa keessan?	1. Qeenxee 3. Kan du'e	

		2. Kan fuudhe 4. kan hiike	
88.	Amantiin keessan maali?	1.protestant 3.musilm 2.orthodox 4.Wakefata 5.kan biro	
89.	Sabummaan keessan maali?	1.Oromo 3.Tigrie 2. Amhara 4. Kan biroo	
90.	Hojiin fi amala kee maali fakkaata? Sa'a meeqaaf hojjetuu?	_____fi_____ _____	
91.	Maatiin keessan galiin/nama ji'aa giddu galeessaan tilmaamame meeqa?	1. $37.5 gadi 2.>$75-100 3.>$100	
92.	Biqiltuu manaa /qonna magaalaa qabduu?	1. Eeyyee 2. Lakki	
93.	Inshuraansii fayyaa qabduu?	2. Eeyyee 2. Lakki	
94.	Qabeenya Quintales/index sararaa gadii?	1. Eeyyee 2. lamaffaa 3. G/galeesaa 4. Afraffaa	

Farii II. **Gaaffilee: adda addummaa nyaataa /nyaata fayya qabeessa madaaluu /FFQ.**

S/n	Gaaffilee	Deebii	Yaada
95.	Midhaan Dheedhii: boqqolloo/boqqolloo, ruuzii, qamadii, midhaanii, midhaanii ykn midhaan ykn nyaata biroo kanneen irraa hojjetaman kamiyyuu (fkn daabboo, noodeelii, daabboo ykn oomishaalee midhaanii biroo) + injera, Pourage.	1 Guyyuu 2. torbeetti al-lama 3. torbeetti al-sadii 4. darbee darbee 5. Tasa nyaadhee hin beeku	
96.	Legumes, pulse fi muuzaa. Akka: Baaqelaa, Baaqelaa, xaafii, Muuzaa, sassaaba, sanyii	1 Guyyuu	

	Niijer ,laansee fi kkf	2. torbeetti al-lama 3. torbeetti al-sadii 4. darbee darbee 5. Tasa nyaadhee hin beeku	
97.	Tuber Adii fi hundee : boqqolloo adii, yaam adii, kaasaavaa adii, ykn nyaata biroo hundee irraa hojjetaman	1 Guyyuu 2. torbeetti al-lama 3. torbeetti al-sadii 4. darbee darbee 5. Tasa nyaadhee hin beeku	
98.	Kuduraalee: -paampii, kaarotaa, iskuwaashii, ykn boqqolloo mi'aawaa keessa isaanii burtukaana ta'an , burtukaana mi'aawaa diimaa, kuduraalee baala magariisa dukkanaa'aa qaban,(bifa bosonaa dabalatee + baala vitaamin A naannootti argamu kan akka amaraan, baala kaasaavaa, kalee, ispinaashii) -kuduraalee biroo (fkn timaatima, basaqaa, eggplant) .	1 Guyyuu 2. torbeetti al-lama 3. torbeetti al-sadii 4. darbee darbee 5. Tasa nyaadhee hin beeku	
99.	Fuduraalee: maangoo bilchaate, kantalooppii, abriikootii (haaraa ykn goggogaa), paapaayaa bilchaate, peechi goggogaa, fi dhangala'aa fuduraa 100% kanneen irraa hojjetame.	1 Guyyuu 2. torbeetti al-lama 3. torbeetti al-sadii 4. darbee darbee 5. Tasa nyaadhee hin beeku	
100.	Foonii fi oomishaalee isaa: Kalee, tiruu, onnee ykn foon qaama biroo ykn	1 Guyyuu	

	nyaata dhiiga irratti hundaa'e, foon loonii, foon allaattii, hoolaa, re'ee, kanniisa, adamsa, hanqaaquu, hantuuta, simbirroota biroo, ilbiisota.	2. torbeetti al-lama 3. torbeetti al-sadii 4. darbee darbee 5. Tasa nyaadhee hin beeku	
101.	Milk and its products: milk, cheese, yogurt or other milk products	1 Guyyuu 2. torbeetti al-lama 3. torbeetti al-sadii 4. darbee darbee 5. Tasa nyaadhee hin beeku	
102.	Eggs from chicken, duck, guinea fowl or any other egg	1 Guyyuu 2. torbeetti al-lama 3. torbeetti al-sadii 4. darbee darbee 5. Tasa nyaadhee hin beeku	
103.	Fishes and other seafood's: fresh or dried fish or shellfish	1 Guyyuu 2. torbeetti al-lama 3. torbeetti al-sadii 4. darbee darbee 5. Tasa nyaadhee hin beeku	
104.	Baala, muuzaa, fi sanyii: baaqelaa goggogaa, baaqelaa goggogaa, qamadii, muuzaa, sanyii ykn nyaata kanneen irraa hojjetaman (fkn. hummus, dhadhaa boqqolloo).	1 Guyyuu 2. torbeetti al-lama 3. torbeetti al-sadii	

		4. darbee darbee 5. Tasa nyaadhee hin beeku	
105.	Cooma fi zayita: zayita, cooma ykn dhadhaa nyaata irratti dabalamu ykn nyaata bilcheessuuf oolu	1. Guyyuu Dhadhaa loon 2. Guyyuu zayita kantare 3.GuyyuuZayitii qulqullaa'e 4. Makaa Dhadhaa fi zayitaa	
106.	Mi'eessituuwwan: sukkaara, damma, soodaa mi'aawaa ykn dhugaatii dhangala'aa mi'aawaa, nyaata sukkaara qabu kan akka chokoleetii, karameellaa, kukii fi keekii/nyaata jal'aa kan akka saanduqa/bargarii	1 Guyyuu 2. torbeetti al-lama 3. torbeetti al-sadii 4. darbee darbee 5. Tasa nyaadhee hin beeku	
107.	Mi'eessituu, mi'eessituu fi dhugaatii: mi'eessituu (birbirsa gurraacha, soogidda), mi'eessituu (soogidda xaafii, soogidda ho'aa), buna, shaayii, dhugaatii alkoolii	1 Guyyuu 2. torbeetti al-lama 3. torbeetti al-sadii 4. darbee darbee 5. Tasa nyaadhee hin beeku	

Garii III. Seenaa sochii qaamaa

S/n	Gaaffilee	Deebii	yaada
108.	Sochii qaamaa irratti bobbaatee beektaa?	1. Eeyye 2. Lakki	
109.	Shaakala erobic ni shaakaltuu?	1. Eeyye 2. Lakkii 3.Darbee darbee	
110.	Sochii qaamaa idilee kam yeroo hunda	1.Deemsa 2.Fiiguun	

	shaakaltu?		3.Sadarkaa ol bahuu 4.Biskileetii oofuu 5.Dhaabbachuu 6.Dabbasuu 7.Iskii qaxxaamura biyyaa	
111.	Sochii qaamaa maashaa cimsuu ni hojjettaa?		1. Eeyye 2. Lakkii 3.Darbee darbee	
112.	Sochii qaamaa guyyaa/torban, daqiiqaa/guyyaa yeroo hammamiif hojjettu?		1.guyyaa3/torban, &150m'/torban 2.3dys/torban,&120-150m'/torban 3.<3dys/torban,&120M'/torban 4. Gonkumaa irratti hin bobba'inaa	
113.	Hojii biqiltuu dhaabuu/qonna magaalaa ni hojjettu?		1. Eeyye 2. Lakkii 3.Darbee darbee	
114.	Sochii qaamaa hojii ni shaakaltuu (yoo xiqqaate guyyaa hojiitti sa'aatii 4 sochii taa'umsa hin qabne keessatti) .		1. Eeyye 2. Lakkii 3.Darbee darbee	
115.	Sochii qaamaa hojii malee (yoo xiqqaate torbanitti sa'aatii 1.5)		1. Eeyye 2. Lakkii 3.Darbee darbee	
116.	Kilabii qaamaa/ispoortii keessatti hirmaachuu		1. Eeyye 2. Lakkii 3.Darbee darbee	
117.	Sochii baay'ee salphaa ta'e	Kutaa fakkii kaasuu, wiilcheeriin dhiibuu, hojii mooraa, sibiilaa, nyaata bilcheessuu fi meeshaa	1. Eeyye 2. Lakkii 3.Darbee darbee	

	irratti bobbaattaa ?	muuziqaa taphachuu.		
118.	Sochii salphaa irratti bobbaattaa ?	Suuta jedhee deemuu (24 min/mile), hojii garaajee, hojii mukaa, mana qulqulleessuu, kunuunsa daa'immanii, goolfii, doonii oofuu, fi teenisii minjaalaa bashannanaa	1. Eeyye 2. Lakkii 3.Darbee darbee	
119.	Sochii giddu galeessaa irratti bobbaattaa	maayilii daqiiqaa 15 miilaan deemuu, iddoo biqiltuu marga ciruu fi qodaa qotuu, fe'umsa baatanii deemuu, biskileetii oofuu, iskii, teenisii fi shubbisuu	1. Eeyye 2. Lakkii 3.Darbee darbee	
120.	Sochii olaanaa irratti bobbaattaa ?	Daqiiqaa 10 keessatti maayilii tokko fiiguun, fe'aa ol ba'ee deemuu, muka muruu, harkaan qotuu ulfaataa, kubbaa miilaa, ol ba'uu fi kubbaa miilaa	1. Eeyye 2. Lakkii 3.Darbee darbee	
121.	Namoota biroo irratti bobbaattaa ta'uu danda'a?	Shaakala daddabbii sochii walqabatee guutuu argatu, shaakala humnaa ykn mormii, fi haala erobiik haala mijeessuu	1. Eeyye 2. Lakkii 3.Darbee darbee	

Garii IV. Haala qulqullina Jireenyaa Fayyaa Walqabatee (Q_5D index score)

	Gaaffilee	Deebii	yaada
122.	Qulqullina jireenyaa Fayyaa wajjin walqabatu	1.Eeyye 2.Lakki	

	ni beektu?		
123.	Beekumsa qulqullina jireenyaa fayyaa wajjin walqabatu argachuuf fedhii qabduu?	1.Eeyye 2.Lakki	
124.	Dhukkubbiin fi miira tasgabbii dhabuun sitti dhagahamaa?	1.Eeyye 2.Lakki 3. Darbee darbee	
125.	Yaaddoo ykn dhiphina sammuu qabdaa?	1.Eeyye 2.Lakki 3. Darbee darbee	
126.	Sochiiwwan barame shaakaltu, dandeettii qabduu?	1.Eeyye 2.Lakki 3. Darbee darbee	
127.	Rakkoo sochii qaamaa qabdaa?	1.Eeyye 2.Lakki 3. Darbee darbee	
128.	Rakkoo of kunuunsuu qabdaa?	1.Eeyye 2.Lakki 3. Darbee darbee	
GariiT V. Seenaa haala Jireenyaa fayya qabeessa of-gabaasa irraa			
129.	Tamboo xuuxuu	1.Eeyye 2.Lakki 3. Darbee darbee	
130.	Alkoolii dhuguu	1.Eeyye 2.Lakki 3. Darbee darbee	
131.	Caayitii qaamuu	1.Eeyye 2.Lakki 3. Darbee darbee	
132.	Jireenya taa'umsaa baayistaa?	1.Eeyye 2.Lakki 3. Darbee darbee	
133.	Nyaata fayya-dhabeessa shaakaluu?	11.Eeyye 2.Lakki 3. Darbee darbee	
134.	Sukkaara dabalataa dabalataa fudhattaniittuu?	1.Eeyye 2.Lakki	

		3. Darbee darbee	
135.	Copha garmalee guutame (zayitii dhangala'e) fayyadamteettaa?	1.Eeyye 2.Lakki 3. Darbee darbee	
136.	Soogidda garmalee fayyadamtee?	1.Eeyye 2.Lakki 3. Darbee darbee	
137.	Guyyaa guyyaan kuduraa fi muduraa nyaachuu(yoo xiqqaate guyyaatti tajaajila 5)	1.Eeyye 2.Lakki 3. Darbee darbee	
138.	Yeroo televijiinii ilaaluu (sa'aatii 2/guyyaa) .	1.Eeyye 2.Lakki 3. Darbee darbee	
139.	Hirriba dhabuu qabdaa?	1.Eeyye 2.Lakki 3. Darbee darbee	

Garii V. Sababoota balaa meetaabolii siindiroomii fi haalawwan fayyaa kanaan walqabatan

140.	Kanaan dura rakkoo fayyaa kamiyyuu ilaaltamtanii beektuu?	1.Eeyye 2.Lakki 3. Darbee darbee	
141.	Haala soorataa keessanii ilaaltaniittuu? Sadarkaa issa?	1.Normal 2.Ulfaatina gadi aanaa 3.Ulfaatina garmalee 4.Furdina garmalee	
142.	Haala Furdinni qaamaa kee ilaalteetta, Yoo eeyyee ta'e? BMI?	1.Giddugaleessa>30.34.9 2.Cimaa>35-39.9BMI 3.Baayyee cimaa>40BMI	
143.	Dhukkuba Sukkaaraa beektuu?	1.Eeyye 2.Lakki	
144.	Dhiibbaa dhiigaa beektuu?	1.Eeyye 2.Lakki	

145.	Dadhabbii /rakkoo Onnee beektuu?		1.Eeyye 2.Lakki	
146.	Dhibee dhiigni sammuu keessatti dhangala'uu (stroke) beektuu?		1.Eeyye 2.Lakki	
147.	Dhukkuba Osteoarthritis/Arthritis qabduu?		1.Eeyye 2.Lakki	
148.	Rakkoo hafuura baafachuu qabdaa?		1.Eeyye 2.Lakki	
149.	Qufaa Yeroo Dheeraa/COPD qabdaa?		1.Eeyye 2.Lakki	
150.	Goginsa garaa/bobbaan sindidaa?		1.Eeyye 2.Lakki	
151.	Fedhiin nyaataa kee ni dabalaa moo ni hir'ata?		1.Eeyye 2.Lakki	
152.	Dyslipidemia qabaachuu isaa ilaaltaniittuu?		1.Eeyye 2.Lakki	
153.	Bishaan liititra meeqa dhugdu guyyaatti?		_____	
Garii.VI: Safartuuwwan antiroopoomeetirii				
154.	Ulfaatina Kiiloogiraaman		_____	
155.	Olka'iinsa seentimeetiraan		_____	
156.	Naannoo mudhii seentimeetiraan		_____	
157.	Naannoo daallee seentimeetiraan		_____	
158.	Reeshiyoo naannoo mudhii fi jilbaa		_____	
159.	Dhiibbaan dhiigaa sistoolikii mmHg		_____	
	Dhiibbaan dhiigaa diyaastoolikii mmHg		_____	
160.	Dhiibbaa dhiigaa mmHg		_____	
Garii VII. Safartuuwwan baayoomarkaraa				
161.	Sadarkaa guluukoosii pilaasmaa soomaa		_____	
162.	Odeeffann	Waliigala tiraayigiliisaayidii(TG)	_____	

	oo coomaa	HDL-C	_____	
		LDL-C	_____	
Garii VIII. Qulqullina: Gaaffiiwwan Qajeelfama/ Garee Xiyyeeffannoo Qajeelfama marii akkaataa jireenya fayya qabeessa madaaluuf Guddifachaa				
Umurii waggaan		1) 41-48, 2) 49-56, 3) 57-64		
	Saala	1.Dhiira 2.Dhalaa		
Domain 1	**Amala nyaataa**	1. Yeroo baay'ee atii fi maatiin kee nyaata akkamii nyaattu? Qorannoo: Yeroo baay'ee atii fi maatiin kee nyaata gosa akkamii nyaattu? Yeroo hammam hammamiitti? Atiifi maatiinkee nyaata akkasii maaliif nyaattu?		
		2. Ati fi maatiin kee zayita/soogidda akkamitti fudhattu? Qorannoo: Ati fi maatiin kee zayita/soogidda meeqa fayyadamtu? Hammi zayita/soogidda atii fi maatiin keessan fayyadamtan garmalee sitti fakkaata? Yoo eeyyee ta'e, hamma zayitaa/soogidda hir'isuu irratti rakkoowwan gurguddoon maal fa'a?		
		3. Atii fi maatiin kee nyaata salphaa fudhattuu? Qorannoo: Ati fi maatiin kee gosa nyaata salphaa akkamii nyaattu? Yeroo hammam hammamiitti? Atiifi maatiinkee maaliif nyaata salphaa akkasii nyaattu?		
		4. Atii fi maatiin kee yeroo baay'ee mana nyaataa keessatti nyaattaa? Qorannoo: Ati fi maatiin kee yeroo meeqa mana nyaataa keessatti nyaattu? Atii fi maatiin kee yeroo akkamii ala nyaattu?		
Domai	**Shaakala sochii**	1. Mana keessattis ta'e bakka hojiitti dabalatee sadarkaa sochii qaamaa keessanii fi maatii keessanii akkamitti		

n2	**qaamaa yeroo hunda gochuu**	madaaltu? Qorannoo: Atii fi maatiin kee sochii qaamaa gosa akkamii jaallattu? Yeroo hammam hammamiitti? Hojiin kee qaama namaa kan gaafatudhaa?	
		2. Atii fi maatiin kee sochii qaamaa yeroo hunda gochuu amala qabdaa? Qorannoo: Atii fi maatiin kee sochii qaamaa yeroo hunda kan gootan yoo ta'e, sababoonni gurguddoon maali? Atii fi maatiin kee sochii qaamaa kamiinuu yoo hin hirmaanne sababoonni gurguddoon maali?	
Domain 3.	**Tamboo xuuxuu fi alkoolii dhuguu**	1. Atii fi maatiin kee alkoolii ni xuuxuu/dhugduu? Qorannoo: Gosa sigaaraa/alkoolii akkamii dhugdu? Yeroo hammam hammamiitti? Ati fi maatiin kee yeroo akkamii tamboo xuuxuu/dhugdu?	
		2. Tamboo xuuxuun/alkoolii dhuguun miidhaa fayyaa irratti fidu ni beektaa? Qorannoo: Rakkoowwan gurguddoon tamboo xuuxuu/alkoolii dhuguu dhiisuu maal fa'a? Amala tamboo xuuxuu/dhuguu kee irratti dhiibbaan/dhiibbaan maatii ykn hawaasa irraa sitti dhaga'amaa?	
		3. Qorannoo "Tamboo fayyadamtaa? Yoo "eeyyee" ta'e, karoora dhaabuuf qabduu? Tooftaa dandamachuu isa kam fayyadamta?" Tooftaalee hirmaattonni hojiirra oolchan gaaffilee hirmaattotaaf ka'an irratti hundaa'uun ramadne (fayyadama hir'isuu, amala gatii xiqqeessuu qofa, fi tooftaalee baasii hir'isan hin qabne).	
Domain 4.	**Amaloota fayyaa walqabatan**	1. Atii fi maatiin kee yeroo dhukkubni sitti dhaga'amu kunuunsa fayyaa ni barbaadduu? Qorannoo: Atii fi maatiin kee yeroo dhukkubni sitti dhaga'amu eessatti kunuunsa fayyaa barbaaddu? Sababoonni gurguddoon achitti	

		kunuunsa fayyaa barbaaduuf maal fa'a?	
		2. Atii fi maatiin kee yeroo hunda qorannoo fayyaa ni fudhattu? Qorannoo: Yoo eeyyee ta'e, atii fi maatiin kee yeroo meeqa qorannoo fayyaa deemtu? Sababoonni gurguddoon maali? Yoo hin taane sababoonni gurguddoon qorannoo fayyaa hin deemneef maali?	
		3. Qajeelfama kilinikaa fi pirootokoolii qorannoo balaa adda ta'e qabduu?	
		4. Jireenyi fayya qabeessa ta'e hakiimota kunuunsa jalqabaa keessan irraa gorsa akka barbaadu ni amantaa? **Qorannoo**: Yoo eeyyee ta'e, atii fi maatiin kee yeroo meeqa jireenya fayya qabeessa ta'e shaakaltuu? Hojiirra oolmaa isaa ilaalchisee ilaalchi maali? Yoo lakki ta'e, sababoonni gurguddoon shaakaluu dhiisuu fi sakatta'iinsa sababoota balaa meetaabolii deemuuf maal fa'a?	
Domain 5.	**Hubannoo fi ejjennoo gara ittisa dhukkuboota daddarboo hin taane**	1. Waa'ee dhukkuba miti-daddarboo/NCD (dhiibbaa dhiigaa, T2DM fi kkf) maal beektu? **Qorannoo**: Mallattoowwan/bu'aan fayyaa dhukkuba NCD (dhiibbaa dhiigaa fi kkf) maal fa'a? Sababoota dhukkuba NCD (dhiibbaa dhiigaa fi kkf) fi akkamitti akka ittisan beektu? Maddoonni odeeffannoo gurguddoon waa'ee dhukkuboota NCD beekumsa fayyaa argachuuf qabdan maali?	
		2. Sagantaa ittisaa fi tajaajila wal'aansaa yeroo ammaa sadarkaa hawaasaa/sabaatti maal jettu? **Qorannoo**: Sagantaawwanii fi tajaajila wal'aansaa sanatti ni quuftaa? Sagantaa gara fuula duraa sadarkaa hawaasaa/sabaatti maal eegdu?	
		3. Bu'uuraaleen teeknooloojii odeeffannoo fi meeshaaleen hawaasni NCD ittisuuf gahaa ta'e ni jiraa jettanii yaaddu?	
GALATOOMAA!			

VII. LETTER FOR DECLARATION

I, the undersigned, declare that this is my bona-fide original work, has never been presented in this or any other University, and that all the resources and materials used for the dissertation, have been fully acknowledged.

Name: **ALEMU ADEBA**

Signature: _____

Date: _____

Place: _____

Date of submission: _____

This dissertation has been submitted for examination with my approval as Candidate's:

First Promoter;

Name: _____

Signature: _____

Date: _____

Second Promoter;

Name: _____

Signature: _____

Date: _____

Plagiarism test Certificate

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Prof.dr. Tefera Belachew	_____	___/___/2023
Advisor	Signature	Date
Dr. Dessalegn Tamiru	_____	___/___/2023
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Prof.dr. Tefera Belachew _____ 19 / 9 /2023

Advisor Signature Date

Dr. Dessalegn Tamiru _____ __/__/2023

Advisor Signature Date

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External Examiner (01) Signature Date

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External Examiner (02) Signature Date

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