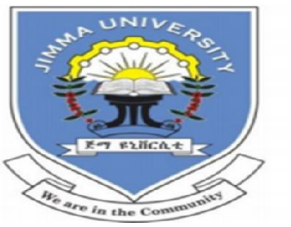

JIMMA UNIVERSITY

INSTITUTE OF HEALTH

COLLEGE OF MEDICAL SCIENCES

DEPARTMENT OF BIOMEDICAL SCIENCES

PREVALENCE AND PREDICTORS OF COGNITIVE IMPAIRMENT AMONG HYPERTENSIVE PATIENTS ON FOLLOW UP AT JIMMA UNIVERSITY MEDICAL CENTER, JIMMA, SOUTHWEST ETHIOPIA

BY: TESEMA ETEFA (BSc.)

A THESIS IS SUBMITTED TO THE DEPARTMENT OF BIOMEDICAL SCIENCES, INSTITUTE OF HEALTH SCIENCES, JIMMA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR MASTER'S DEGREE IN CLINICAL ANATOMY

NOVEMBER 2018

JIMMA, ETHIOPIA

PREVALENCE AND PREDICTORS OF COGNITIVE IMPAIRMENT AMONG HYPERTENSIVE PATIENTS ON FOLLOW UP AT JIMMA UNIVERSITY MEDICAL CENTER, JIMMA, SOUTHWEST ETHIOPIA

By: Tesema Etefa (BSc.)

Principal advisor:

1. Asfaw Gerbi (MSc, Assistant Prof, PhD Candidate)

Co-advisor:

2. Mengistu Ayele (MSc)

NOVEMBER 2018

JIMMA, ETHIOPIA

ABSTRACT

***BACKGROUND**: Cognitive impairment is a condition when a person suffers from recalling, learning new things, concentrating, or making decisions that affect their everyday life. Hypertension is highly prevalent disease affecting around one billion individuals worldwide and 55.2% African population Hypertension has been associated with reduced abstract reasoning (executive dysfunction), slowing of mental processing speed and memory deficits, The blood vessels in the prefrontal subcortical areas are often affected by sever hypertension, which can affect the ability to make executive decisions and other brain function .*

***OBJECTIVES**: To determine the prevalence and predictor of cognitive impairment among hypertensive patients on follow up at Jimma University Medical Centre, Jimma, Southwest Ethiopia, 2018*

***METHODS**: Institution based cross sectional study design was employed from June 01 to July 15, 2018 among 279 hypertensive patients on follow-up at Jimma University Medical Centre chronic clinic, Jimma, Ethiopia. The data collection tools contained sociodemographic characteristics, Mini Mental State Examination (MMSE), substance use, medical history, blood pressure and somatic measurements such as body weight and height. The MMSE scale was used to measure cognition* level. *The collected data were cleared and entered into SPSS Version 20.0 for analysis. The association between the independent variables and the outcome variable (cognition level) was analyzed using logistic regression model. A p-value of <0.05 was considered statistically significant in the final model.*

***RESULTS**: Out of the 279 hypertensive patients included in this study, 142 (50.9%) were male and the remaining proportion was female. The mean age ± SD of the participants was 53.15 $\pm$ 11.544 years with a range of 20 to 86 years. Nearly two-third (178, 63.8%) of the participants were aged between 40 and 59 years. The prevalence of cognitive impairment (less than 24 out 30 on MMSE scale) in this study was 108 (38.7%). Cigarette smoking (AOR=4.302, 95% CI: 1.106-16.734), physical inactivity (AOR=2.05, 95% CI: 1.05-5.97), triglycerides level $\geq$ 200 mg/dl (AOR=4.48, 95% CI: 1.898-10.587) and Stage I (AOR=5.125; 95% CI: 2.052-12.802)*

and Stage II hypertension (AOR=3.434; 95% CI: 1.498-7.871) were significantly associated with cognitive level.

***CONCLUSION**: Cognitive impairment was relatively common in the study population. The study revealed that cigarette smoking, lack of physical activity, high triglyceride levels and Stage I and II HTN were significantly associated with cognitive impairment.*

***KEYWORDS:** Cognition, Cognitive Impairment, Hypertension, MMSE, Jimma University*

ACKNOWLEDGMENTS

I would like to thank almighty God to help me do this thesis. I would like to express my sincere gratitude to my advisors, Mr. Asfaw Gerbi and Mr. Mengistu Ayele for the continuous support of my study, for their patience, motivation, and immense knowledge. Their guidance helped me in all the time of research and writing of this thesis. Their smart comments and suggestions have added considerably to the clarity and organization of this work.

I express special thanks to my dear family, relatives and friends who have always been with me, from the beginning and for always helping and encouraging me. I also wish to thank the study participants, data collectors and post graduate office of Jimma University for the financial and material support and department of Biomedical Sciences and staff members for their direct or indirect support, Jimma University for covering my living expense throughout my study period.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

AD	Alzheimer's disease
AOR	Adjusted Odds ratio
Aβ	amyloid β
BBB	Blood brain barrier
BMI	Body mass index
BP	Blood pressure
CBF	Cerebral blood flow
CDC	Communicable disease control
CI	Cognitive impairment
CNS	Central Nervous System
CoI	Cognitive impairment
COPD	chronic obstructive pulmonary disease
COR	Crude odd ratio
DBP	Diastolic blood pressure
DM	Diabetes mellitus
HDL	High density lipoprotein
HTN	Hypertension
JU	Jimma University
JUMC	Jimma University Medical Centre
Kg	kilogram
KM	kilometer
LDL	Low density lipoprotein
MAP	Mean arterial pressure
MCI	Mild cognitive impairment
MMSE	Mini-mental state examination
MRI	magnetic resonance images
NCD	Non-communicable disease
NHANES III	National health and nutrition examination survey
pts	points
SBI	Small blood infraction
SBP	Systolic blood pressure
SD	Standard deviation
SPSS	Statistical package for Social Science
TC	Total cholesterol
TG	Triglycerides
UK	United kingdom
USA	United states of America
VCI	Vascular cognitive impairment
WMCs	White matter changes
WMLs	White matter lesions

1. INTRODUCTION

1.1. Background of the Study

Cognition states for the processing of information, applying knowledge and changing preference. Cognitive function majorly includes focused attention, executive function, recall, producing and understanding language, solving problem and making decisions (1). Cognitive impairment is when a person has suffered recalling, learning new things, concentrating, or making decisions that affect his/her everyday life. Cognitive impairment ranges from mild to severe (2).

Hypertension, a chronic elevation in blood pressure exceeding 140 mmHg systolic or 90 mmHg diastolic, can lead to target organs damage (brain, heart and kidneys) inducing detrimental events. Cerebral blood vessels are the main target of the deleterious effects of hypertension on the brain (3). Hypertension causes typical alterations in small arteries and arterioles supplying the subcortical and basal ganglia white matter, resulting in small vessel disease, a major cause of lacunar strokes and cerebral hemispheric white matter damage (4). The resulting structural and functional cerebrovascular alterations underlie many of the neuron pathological abnormalities responsible for the cognitive deficits, including white matter damage, microinfarcts, microbleeds, silent brain infarcts, and brain atrophy (4).Hypertension is the most influential risk factor for the development of cerebrovascular damage, and the dramatic reduction in stroke mortality over the past several decades has been attributed to the treatment of hypertension (5). Hypertension induces vascular alteration and lead to cognitive impairment by leading to hypoperfusion, ischemic and hemorrhagic stroke, and white matter injury (6). Hypertension is also a risk factor for lowered cognitive function in persons free from clinically diagnosed stroke and dementia (7). Moreover, reduced abstract reasoning (executive dysfunction), slowing of mental processing speed and memory deficits are reported in association with hypertension (8).

Hypertension is highly prevalent disease affecting an estimated 80 million people in the United States and 1 billion individuals worldwide (9). The number of adults with hypertension will increase in 2025 to 1·56 billion of the total population (1·54–1·58 billion) (10). In Africa, systematic review and meta-analysis show that prevalence of hypertension was 55.2% (11). Systematic review with meta-analysis show that the prevalence of hypertension in Ethiopia was estimated to be 19.6 % (23.5 % in urban population and 14.7 % in rural population) (12). The prevalence of hypertension (HTN) is increasing in the

pediatric population and is now up to 3-4% (13). Hypertensive elderly individuals appear to demonstrate declines in measures of global cognition (14), including working memory (15), attention (16), and executive functioning (17). Study conducted on the effects of hypertension on cognitive function with emphasis on psychomotor speed of air traffic controllers and pilots since the 1960s demonstrated reduced performance in individuals with hypertension (18).

In adults, the effect of hypertension on the brain is due to systolic blood pressure(SBP) exceeding the autoregulatory mechanisms of the brain and consequences damage to small cerebral vessels that can lead to impaired autoregulation, lacunar infarcts, amyloid angiopathy and cerebral atrophy (13). Cognitive deficits in adults from HTN can be difficult to detect but may be divided into several domains including learning, memory and attention (19). The blood vessels in the prefrontal subcortical areas are often affected by severe HTN, which can affect the ability to make executive decisions (e.g., planning, attention, problem solving, verbal reasoning, etc.).

Adults with HTN had reduced cerebral blood flow to areas of the brain that are normally active during performance of cognitive tasks pertaining to memory (20). Children with HTN are being more frequently screened for end organ damage but methods to screen for cognitive dysfunction have not been extensively discovered (20). Deficits in attention speed and executive function were present in 46% of hypertensive patients compared to 13% of normotensive subjects (21). The differentiation of the frontal lobes as a result of lesions in prefrontal, dorsolateral, orbitofrontal and anterior cingulate that connect the sub cortex with region brings about “executive dysfunction and characterized by impaired performance of mental operations, psychomotor retardation, attention deficit ,visual and spatial alterations, difficulty in planning and starting an activity, apathy and loss of inhibition (21). Changes in the blood-brain barrier may result in increased vascular permeability, protein extravasations in the brain parenchyma, leading to amyloid β protein (Aβ) accumulation. It is also possible mechanisms responsible for cognitive loss and AD pathology (22).Vascular oxidative stress and inflammation obstruct the proliferation, migration and differentiation of oligodendrocyte progenitor cells and compromise repair of the damaged white matter (23). Furthermore, loss of growth factors, such as the brain-derived neurotropic factor, may contribute to the brain atrophy associated with vascular cognitive impairment (VCI) (24).

Cross-sectional and longitudinal studies consistently show that increasing levels of plasma homocysteine are associated with poorer performance in global as well as multiple cognitive domains (25).

1.2. Statement of the Problem

Cognitive impairment is a growing public health concern (26). Aging, lifestyles and chronic diseases such as hypertension and Type 2 diabetes mellitus, are the most important contributing factors for the development and progression towards cognitive impairment (27). Cardiovascular risk factors have been shown to be associated with poor cognitive function in middle-aged adults and also with dementia in later life. Hypertension primarily affects the brain leading to cognitive disorders and AD (28). Increment in blood pressure in the brain leads to a breakdown of cerebral vasculature and causes disruption of neurovascular units and the lack of regulation, induces a degeneration of the cerebral tissues, consequently lead to brain damage (29). Studies show that, accumulating epidemiologic and mechanistic evidence has shown that hypertension is also an important risk factor for dementia, Alzheimer's disease and mild cognitive impairment (30). White matter degeneration and microbleeds tissue damage reflect, primary small vessel disease are associated with focal infarct or diffuse tissue damage, result in non-morphologic functional changes (31).

Hypertension is an overwhelming global challenge, which ranks third as a means of reduction in disability-adjusted life-years (10). Besides, it is the leading cause of mortality (32). Globally, nearly one billion people have hypertension; of these, two-thirds are in developing countries (33). The global incidence rate of mild cognitive impairment (MCI) was 9.9/1,000 person–years. MCI was a good predictor of Alzheimer's disease with an annual conversion rate of 8.3% ,but it is very unstable over time: Within 2 to 3 years, only 6% of the subjects continued to have MCI, whereas 40% reverted to normal (34). Age-standardized prevalence for those aged 60 years varied in a narrow band, 5%–7% in most world regions (35). Previous studies in Latin America have reported a prevalence of cognitive impairment between 1% to 28% in the general population (36), whereas dementia was present in 3.4% to 7.1% (37). Reports showed prevalence of MCI in India (6%), China (4.5%) with higher prevalence in Malaysia (15.4%) and South Korea (9.7%) (38). A systematic review of Sub-Saharan nations showed higher range of cognitive impairments; Benin (10.4%), Botswana (9%), Central Africa republic (26%), Congo (18.8%), Nigeria (11.8%) (39).

To the knowledge of the investigators, there is no study conducted on cognitive impairment among hypertensive patients in Ethiopia. However there are some studies that investigated the association of one of the chronic diseases, diabetes mellitus (DM) and cognitive impairment. Institution based cross-sectional study conducted showed that, 45% Type 2 DM patients had cognitive impairment (29.6% mild and 15.4% moderate), 45.8% of impaired cases had cardiovascular problems of which 84.1% were hypertensive (40). Another study conducted in Manipal using comparative cross- sectional study design showed a higher memory impairment among Type 2 DM (1).

The Purpose of this study was to determine the prevalence and severity of cognitive impairment, and its predictors among hypertensive patients having a follow up at chronic clinic of Jimma University Medical Center (JUMC).

1.3. Significance of the Study

Hypertension is one of recent growing public health problem in many developing countries including Ethiopia. In Ethiopia there is no study published on cognitive impairment among hypertensive patients. Therefore, the results of this study will help health policy makers to give special considerations for cognitive impairment among hypertensive patients during designing diagnosis and management strategies.

The study result will be used particularly in counseling of prevention of the risk factors. It identifies modifiable risk factors. It also adds additional knowledge besides the existing literatures. This study is important for further researchers as a baseline for study on this area.

.

2. LITERATURE REVIEW

2.1. Prevalence of cognitive impairment among hypertension and general population

Numerous studies have demonstrated that hypertension increases the risk for cognitive impairment, vascular dementia, and AD (41). Hypertension was one of the risk factors significantly associated with the presence of white matter lesions (WMLs), which are in turn associated with impaired cognitive function (42). Cerebral magnetic resonance images (MRI) of such patients show white matter lesions. Grade 3 and higher lesions were 2.34 times increased in all persons with hypertension and 3.40 times increased in persons with treated uncontrolled hypertension (42). According to study conducted in Brazil, the prevalence of cognitive impairment, norm tension and HTN was 7% and 23% respectively (43). According to study conducted in Brazil the incidence of mild cognitive impairment (MCI) is 13.2 per 1000 person-years and for Alzheimer's disease (AD) is 14.8 per 1000 person-years (44). According to study conducted in Egypt, from 77 hypertensive patient, uncontrolled blood pressure patients had 55.6% of the mild cognitive impairment group, 63.2% of the moderate cognitive impairment group, and 81.8% of the severe cognitive impairment group (45). Prospective cross-sectional done in Poland show that, the prevalence cognitive impairment occurred in 60% of the patients (25.3% moderate, 17.7% mild, 13.7% cognitive impairment without dementia and 10 3.3% severe) (46). According to study conducted in Iran, 61.5% of participants had impaired cognition and no significant difference between impaired cognition in hypertensive and normotensive groups (61% and 63.9% respectively) (47).

In a prospective study conducted in USA, Women with a blood pressure of 140/90 mmHg or higher despite antihypertensive drug therapy had a 30% increased risk of developing cognitive impairment (48). Hypertension is the main risk factor for the development of ischemic white matter lesions in the brain (49). Cross sectional study conducted in china shown, overall, the mean MMSE score was 27.0±3.6, and the prevalence of MCI among hypertensive patient were 15.4% and the prevalence of MCI showed little difference between males (16.0%) and females (15.1%) (50). Prospective Cohort study done in Peru show that the prevalence of cognitive impairment was present in 63.3% of individuals when using the MMSE (51).

The prevalence of WMCs and SBIs increased with age. the prevalence was 2.4%, 9%, and 32% for subjects in their 50s, 60s, and 70s respectively and hypertension, abdominal obesity, increased levels of homocysteine and high sensitivity C-reactive protein were significantly associated with cerebral white matter change and Silent infract on brain (52).

2.2. Predictors of cognitive impairment

Recent findings in subjects of the Coronary Artery Risk Development in Young Adults with mean age of 25 years at baseline showed that higher burden of SBP over 25 years from young adulthood to middle age was associated with worse performance on several cognitive tests in midlife. These include verbal memory, processing speed, and executive function (53). According to independent studies conducted in Brazil and Angola, age, stage of HTN, and educational level were the variables that strongly predicted cognitive impairment (43, 62). Study conducted in Egypt show that, the metabolic risk factors, diabetes mellitus, hypertension stage, Waist circumference, high triglyceride and low HDL levels affected the MMSE total score and significantly associated with MCI (54). According to study conducted in UK ,Low and high DBP and MAP were associated with cognitive impairment 20 years later (55). Institutional based cross-sectional study was conducted India show, SBP, DBP and age independently statistically significant with cognitive function (56).

Extensive white matter disease has also been shown to be associated with reduced cerebral metabolism in the frontal lobes ,reflecting preferential impairment of the frontal-subcortical circuits affected most by hypertension (57).Silent cerebral white matter lesions (WMLs) are a common finding on brain MRI, especially in the elderly, and these are an important prognostic factor for stroke, cognitive impairment, dementia, and death and in hypertensive patients occur earlier in life and appear more extensive (45).

Increased SBP have association with poor performance on cognitive tests and was found in 2727 men and women of ages 20 to 59 who participated in NHANES III (58). According to study done in Edinburgh, smoking and elevated blood pressure may be risk factors for cognitive decline; smoking was negatively associated with all the cognitive test (59). Study done in Pittsburgh show that, interaction of SBP by age was a significant predictor of performance on the test of verbal learning and attention and higher SBP was associated with poorer performance in those younger than 40 years (60). Cognitive disorders associated with the presence of focal ischemic lesions (infarction, lacunae) and chronic ischemia of the white

matter due to small cerebral artery diseases including arteriosclerosis and lipohyalinosis (61).

According to study done in Angola, age, stage of HTN and education level were the variables that mainly predicted the cognitive impairment (62). A cohort study of 13476 African-American and white participants indicated that midlife hypertension was associated with more cognitive decline over the 20-year study period (63). The study done in USA has shown that, higher BMI was associated with decreased gray matter volumes in the left orbitofrontal, right inferior frontal, right precentral gyri, parahippocampal, fusiform, and lingual gyri, and right cerebellar regions, as well as increased volumes of white matter in the frontal, temporal, and parietal lobes, even when hypertension was considered (64).

Elevated SBP, (≥160 mm Hg) was associated with low brain weight and greater numbers of neuritic plaques in both neocortex and hippocampus and DBP elevation, (≥95 mm Hg) was associated with greater numbers of neurofibrillary tangles in hippocampus, results in association of high BP with neuropathic cerebrovascular lesions and a direct relationship with brain atrophy, neuritic plaques and neurofibrillary tangles (65). High blood pressure is a recognized risk factor for white matter (subcortical) damage which results in impaired cognition, in particular reduced psycho- motor speed, attention, working memory and executive function (66). Hypertension also decrease the number of nicotinic receptors sensitive to acetylcholine a cause cerebrovascular diseases, cerebral infarction, cerebral gray substances, arteriosclerosis and lower cognitive function (67).

One of the most well-established proxy measures of reserve capacity in the elderly is educational attainment, which is thought to reflect the more-effective use of brain networks or cognitive Paradigms (68). Both North America and Europe have suggested that educational attainment is associated with better cognitive performance and reduced risk for cognitive impairment and dementia in later life (69). Various cognitive assessments scores, including MMSE scores, and reported that poorer blood pressure control was associated with impaired cognition among treated hypertensive subjects(30). Case-control study done in china show that elevated plasma HDL and triglyceride were associated with the occurrence of MCI (70).

Study conducted in Birmingham show that higher diastolic blood pressure was cross-sectional and independently associated with impaired cognitive status (71). In children, isolated systolic hypertension is more common than isolated diastolic or combined systolic and diastolic hypertension (72). Another possible mechanism is that TG levels may cause changes in dynamics of leptin, a hormone that is released from adiposities and helps to regulate energy balance (73). High TG levels prevent leptin from crossing the BBB (74), leptin enhances cognition. Studies have shown that higher leptin levels slow the rate of cognitive decline (75) and that leptin replacement improves neurocognition (76). Thus, the effects of TGs on cognition may be mediated by alterations in leptin levels.

According to study done in London ,smoking was associated with faster declines in verbal memory and with slower visual search speeds, highly affect individual who were smoke more than 20 cigarettes per day (77). Cigarette smoking, apart from acting synergistically with systolic blood pressure to cause vascular endothelial damage, has also been found to reduce neurogenesis and increase death of brain cells (78). The study conducted in India show that education (illiterate, secondary, higher secondary and above), smoking (ever smoker and nonsmoker) and alcohol (never/occasional and regular) not negatively associated with cognitive impairment among hypertensive patients (56).Longitudinal Study done in Korean show that, changes in the physical activity level were significantly associated with cognitive decline during the 2-year interval (79). Population-based survey study in Taiwan show that, Low physical activity was significantly associated with increased risk of cognitive impairment in older adults (80). Physical exercise-mediated increase in brain-derived neurotropic factors and cerebral blood flow and a decrease in abnormal protein deposition and systemic inflammation may moderate neurodegenerative changes (81).

2.3. Other Possible Risk Factors for Cognitive Impairment

Cognitive impairment is also caused following chronic diseases. Prevalence of depression, among Type 2 DM patients in Ethiopia was estimated 9.1% for the country (82), and 43.6% in Jimma University specialized hospital. These reports indicate substantial contribution of DM towards cognitive impairment in Ethiopia. Longitudinal and health and retirement survey in America revealed that the prevalence of mild cognitive impairment among chronic obstructive pulmonary disease (COPD) patients as 17.5% (83). Rheumatoid arthritis affects not only joints but also imposes extra articular complications like cognitive impairment which leads to 31% cognitive impairment (84). Cognitive impairment affects 50% HIV-1 patients (85).

2.4. Conceptual framework of cognitive impairment among hypertensive patient

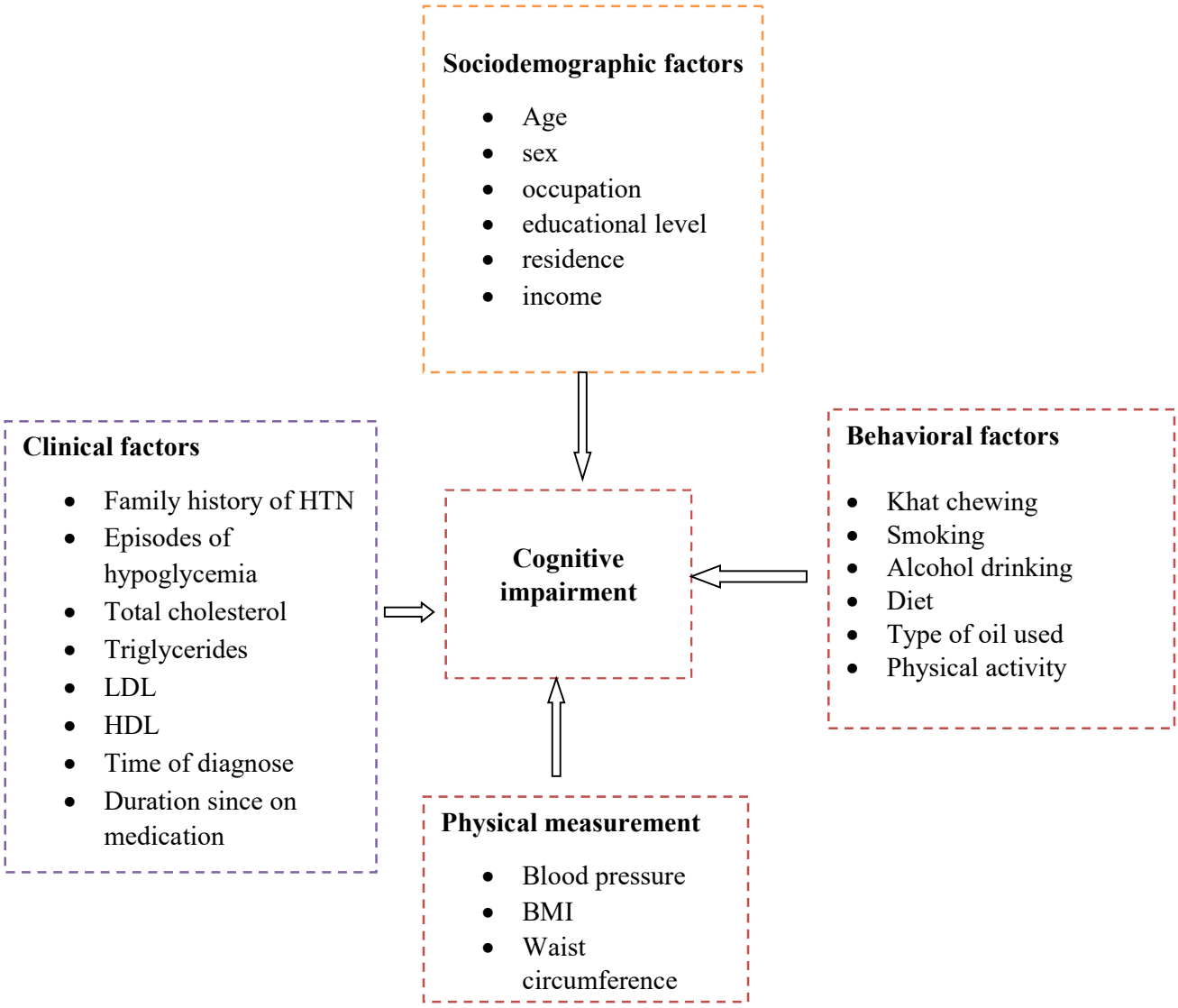

Figure 1**:** Conceptual framework of cognitive impairment among hypertensive patients.

3. OBJECTIVES

3.1. General Objective

- To determine the prevalence and predictors of cognitive impairment among hypertensive patients on follow up at Jimma University Medical Centre, Jimma, Southwest Ethiopia

3.2. Specific Objectives

- To estimate the prevalence of cognitive impairment among hypertensive patients
- To determine the severity of cognitive impairment among hypertensive patients
- To determine factors associated with cognitive impairment among hypertensive patients

4. METHOD AND MATERIALS

4.1. Study area and Period

The study was conducted at Jimma University Medical Center (JUMC) chronic clinic, Jimma town. Jimma town is located 352 kilometers (km) Southwest of Addis Ababa, capital of Ethiopia. JUMC is one of the oldest university hospitals in Ethiopia. Currently it is one of the teaching and referral hospitals in the Southwestern part of the country, providing services for approximately 15 million people in the catchment area including chronic follow up for diabetes mellitus, hypertension and other chronic cases (Hospital record). Follow-up care for hypertensive patients runs weekly on Wednesday. The study was conducted from June 01 to July 15, 2018.

4.2. Study design

Institutional based cross-sectional study design was conducted among hypertensive patients.

4.3. Source population

All adult hypertensive patients on follow up at JUMC chronic clinic were our target population. Data obtained from the clinic show 875 HTN patients are registered and attending regular follow-up. These 875 patients were used as source population in this study.

4.4. Study population

The study subjects were those hypertensive patients the chronic clinic and who fulfilled eligibility criteria and willing to participate

4.5. Sample size

The samples size was estimated by a single population proportion formula with finite population correction. The following parameters were considered 50% prevalence, 95% confidence interval, 5% margin of error.

$$n = \frac{(z_{\alpha/2})^2 \cdot pq}{d^2}$$

Where*; n* – sample size

$Z\,\alpha/2$ – Confidence interval = 1.96

P – Prevalence of cognitive impairment among hypertensive patients, estimated 50%

d – Margin of error = 5%

With the above assumptions, the calculated sample size was 384.

Since the estimated total population of hypertensive patients on follow up (N) in the chronic clinic was less than 10,000 we use correction formula.

$$nf = n/(1 + \frac{n}{N})$$

nf = final sample size for the targeted population

n= calculated sample size (384)

N= total targeted population (875)

Then the final sample size according to these equation yields 267 and adding 10% for non-response (27) it becomes 294.

4.5.1. Sampling technique

Consecutive sampling technique was used to enroll the study participants. Currently a total of 875 hypertensive patients were registered for follow-up at JUMC chronic clinic (Hospital record overview).

4.6. Data collection technique

Data was collected using interviewer-administered structured questionnaire prepared particularly for this study, adapted from WHO STEP wise approach for chronic disease risk factor surveillance (86). The questionnaire was prepared in English language, translated to local languages and then translated back to English to check for consistency. The questionnaire was developed based on the study objectives. The questionnaire contains socio demographic factors, clinical variables such as blood pressure, behavioral variables and anthropometric measurements of body weight, height and waist circumference,}.

To measure cognitive function standard validated MMSE tool containing five components (orientation (10pts.), registration (3pts.), calculation (5pts), recall (3pts), language and drawing (9pts)) was used. The total score obtained for each study subject was 30.

Chart review checklist was used to collect data concerning clinical variables (recorded laboratory result). Blood pressure was measured using Omron digital blood pressure measuring device. For each patient, three measurements were taken with two minutes interval and then the average was taken as a final data for analysis.

Waist circumference was measured with a flexible inelastic tape placed on the midpoint between the lower rib margin and the iliac crest in a perpendicular plane to the long axis of the body. Height and weight were measured using a portable Stadiometer. Body Mass Index was calculated using a person's body weight in kg and body height in meters. The formula used was BMI = kg/m^2 where kg is a person's weight in kilograms and m^2 is their height in meters squared. Four data collectors (2 BSc nurse and 2 psychiatry nurses) were involved in data collection and collection process was supervised.

4.7. Inclusion and exclusion criteria

4.7.1. Inclusion criteria

All hypertensive patients

4.7.2. Exclusion criteria

The following patient were excluded

- Those who refuse to participate on the study.
- Age <18 years
- Pregnant mothers
- Those who diagnosed with mental illness
- Those who had co-morbidity (left ventricular hypertrophy, congestive heart failure, Diabetes mellitus and kidney disease)

4.8. Study variables

4.8.1 Dependent variable

Cognitive impairment is when a person has trouble remembering, recall, orientation, registration, attention and calculation, language and praxis. MMSE is a commonly used 30-point scale for assessing cognitive function in orientation, registration, attention and calculation, recall, language, and drawing. MMSE administration was performed according to existing standards (87).

4.8.2 Independent variables

- **Sociodemographic factors**
  - Age,
  - Sex,
  - Occupation
  - Income,
  - Educational level,
  - Marital status,
  - Residence,
  - Religion,
- **Behavioral related factors**
  - Khat chewing
  - Cigarette smoking
  - Alcohol intake
  - Physical activity
  - Coffee intake
- **Clinical related factors**
  - Family history of HTN
  - Episodes of hypoglycemia
  - Lipid profile
  - Time of diagnosis
  - Duration of disease
- **Physical measurement**
  - BMI
  - Blood pressure
  - Waist circumference

4.9. Operational definitions

- **Cognitive impairment**- is when a person has trouble remembering, recall, orientation, registration, attention and calculation, language and praxis.
- MMSE is a commonly used 30-point scale for assessing cognitive function in orientation, registration, attention and calculation, recall, language, and drawing. MMSE administration was performed according to existing standards (87).
- **Mild cognitive impairment**-- a score of 18-24/30 on MMSE
- **Moderate cognitive impairment**- a score of 10-17/30 on MMSE
- **Severe cognitive impairment**-- a score of 0-9/30 on MMSE
- **No cognitive impairment** – a score of 25-30/30 on MMSE.

Hypertension- a person having Systolic blood pressure of 140mmHg and/or Diastolic blood pressure of 90mmHg and above

- Pre hypertension-SBP 120-139 and DBP 80-89
- Stage I HTN-SBP 140-159 and DBP 90-99
- Stage II HTN- SBP $\geq$160 and DBP $\geq$100

Physical activity: According to WHO, adults and older adults are recommended to do a minimum of 150 moderate intensity or 75 min vigorous intensity aerobic activity or their equivalent combination per week, and muscle strengthening activates or at least 30 minutes of moderate intensity activity on 5 days a week has active physical activity otherwise not.

4.10. Statistical analysis

Data was cleaned and entered into the computer using Epi-Data version 3.1 and exported to the Statistical package for Social Science (SPSS) version 20.0 for analysis. Frequency, percentage and mean were computed for descriptive statistics. The association between the independent and dependent variables were analyzed using logistic regression model. Bivariate analysis was done to select candidates for multivariate at $p < 0.25$. From multivariate logistic regression, independent variables having a p-value < 0.05 with 95% confidence interval were declared as significantly associated with cognitive impairment. Finally, model fitness was checked by Hosmer and Lameshow test (p-value >0.05). Results were organized by using frequency tables, graphs and charts.

4.11. Data quality assurance

The following measures were taken to assure quality of data: Before data collection, data collectors were trained by the principal investigator for one day on the objectives of the study, interviewing, on chart review contents and measurement techniques. The data collection instruments were pre-tested on the hypertensive patients at Shene Gebe hospital (on 5% of the sample size) and necessary modifications was made based on results of the pre-test. Data was checked for completeness within 24 hours. Data cleaning and verification was done before entry into SPSS.

4.12. Ethical consideration

The study was conducted after ethical approval from Jimma University Ethics Review Committee. Letter was given to JUMC after permission secured from the hospital data collection was started. Written, informed consent was obtained for all participating subjects in the local language prior to interview during the whole study period. Data obtained during the study was treated as confidential and the records. The right of patients to withdraw from the interview or not to participate was respected.

4.13. Dissemination plan

A result of the study was compiled in the form of thesis, and will be communicated to all concerned bodies and institutions. Attempts will be made to present findings on scientific conferences and to publish on peer reviewed journal.

5. RESULTS

5.1. Sociodemographic characteristics of study participants

A total of 294 hypertensive patients were enrolled into the study. Due to incomplete information on the laboratory record, 15patients were not included in the analysis and hence the final analysis included 279 subjects. Out of 279 hypertensive patients included, 142 (50.9%) were males. The mean age of participants was 53.15 ±11.544 years with range of 20 to 86 years. Around two-third of them 178 (63.8%) were in age group between 40 and 59 years. Nearly half of the respondent 138 (49.5%) were Muslim. More than half of the respondents 159 (57%) were Oromo. More than two-third of the respondents 188 (67.4) live in urban. Majority of the study participants 232(84.2%) were enrolled in formal education (as indicated in Table 1).

Table 1: Sociodemographic characteristic of hypertensive patients studied for cognitive impairment at follow up in chronic clinic, JUMC, 2018

Variable (n=279)	Frequency, n (%)
Sex	
Male	142 (50.9)
Female	137 (49.1)
Age	
20-39	22 (7.9)
40-59	178 (63.8)
60+	79 (28.3)
Religion	
Orthodox	110 (39.4)
Muslim	138 (49.5)
Protestant	24 (8.6)
Catholic	4 (1.4)
Others*	3 (1.1)
Ethnicity	
Oromo	159 (57.0)
Amhara	53 (19.0)
Kaffa	34(12.2)
Tigrey	6 (2.2)
Gurage	15 (5.4)
Others†	12 (4.2)
Residence	
Urban	188 (67.4)
Rural	91 (32.6)

Table 1. Cont.

Variable (n=279)	Frequency, n (%)
Educational status	
Grade 8 and lower	153 (54.8)
Grade 9-12	60 (21.5)
College and above	66 (23.7)
Marital status	
Single	9 (3.2)
Married	230 (82.4)
Widow	27 (9.7)
Divorced	13 (4.7)
Current occupation	
Unemployed	38 (13.6)
Employed	67 (24.0)
Merchant	32 (11.5)
Farmer	53 (19.0)
Government official	70 (25.1)
Daily laborer	8 (2.9)
Others‡	11 (3.9)
Income (in Ethiopia birr)	
≤ 500	30 (10.8)
501-1500	77 (27.6)
1501-2500	35 (12.5)
>2501	137 (49.1)

*Wakefata and the like; †Dawro and Silte; ‡Retired, housemaid, NGO

5.2. Behavioral factors

About 94(33.7%) respondents were Khat chewers. Among those who were Khat chewers 69(24.5%) consumed sometimes. Regarding the status of smoking, 18(6.5%) were cigarette smokers, about 16(6.5%) were sometimes cigarette smokers. As shown in Table 2, forty-nine (17.6%) respondents were alcohol drinkers, among which 44 (15.8%) drink in a frequency of sometimes. Majority of the respondents 246(88.2%) had history of coffee drinking. Regarding to the frequency of coffee drinking, about 119(42.6%) of respondents were always drinkers. Majority, 237(84.9%) were physically active (Table 2).

Table 2: Behavioral factors of hypertensive patients studied for cognitive impairment at follow up in chronic clinic, JUMC, 2018

Variable (N=279)	Frequency (%)
Khat chewing	
Yes	94 (33.7)
No	185 (66.3)
Frequency of Khat chewing	
Always	7 (2.5)
Sometimes	69 (24.7)
Rarely	18 (6.5)
Cigarettes smoking	
Yes	18 (6.5)
No	261 (93.5)
Frequency of smoking	
Sometimes	16 (5.8)
Rarely	2 (0.7)
Alcohol	
Yes	49 (17.6)
No	230 (82.4)
Frequency of alcohol drinking	
Sometimes	44 (15.8)
Rarely	5 (1.8)
Coffee	
Yes	246 (88.2)
No	33 (11.8)
Physical activity	
Inactive	42 (15.1)
Active	237 (84.9)
Vegetable use/week	
None	19 (6.8)
1-3 days	185 (66.3)
4-7 days	75 (26.9)
Fruit use/week	
None	34 (12.1)
1-3 days	167 (59.9)
4-7 days	78 (28.0)
Type of oil used	
Vegetable oil	196 (70.3)
Butter/ghee	40 (14.3)
Other	12 (4.3)
Do not known	31 (11.1)

5.3. Clinical factors

Clinical characteristics of the study patients were shown in Table 3. In past two month, 52 (18.6%) of respondents were treated for raised cholesterol with drugs. Regarding the fasting blood glucose level 23 (8.3%) had above 126mg/dl. Around one-fourth of the respondents, 67 (24.0%) had high triglycerides level, 33 (11.8%) had high cholesterol level and 28 (10.0%) had high low-density lipoprotein. Abnormal high-density lipoprotein in males and females were 50 (17.9%) and 74 (26.5%) respectively. Almost half of the respondent's duration of diagnosis 137(49.1%) were < 5 years. Above half of respondents were on medication 148(53%) <5 years duration (Table 3).

Table 3: Clinical characteristic of hypertensive patients studied for cognitive impairment at follow up in chronic clinic, JUMC, 2018

Variables (N=279)	Frequency (%)
Family history of HTN	
Yes	77 (27.6)
No	202 (72.4)
Treated for raised cholesterol	
Yes	52 (18.6)
No	227 (81.4)
Fasting blood sugar (mg/dL)	
None	160 (57.3)
< 126	96 (34.4)
≥ 126	23 (8.3)
Total cholesterol (mg/dL)	
≤ 200	192 (68.8)
201-239	54 (19.4)
≥ 240	33 (11.8)
Triglyceride (mg/dL)	
≤ 150	132 (47.3)
151-199	80 (28.7)
≥ 200	67 (24.0)
LDL (mg/dL)	
≤ 100	150 (53.8)
101-159	101 (36.2)
≥ 160	28 (10.0)

Table 3. Cont.	
Variables (N=279)	**Frequency (%)**
HDL (mg/dL)	
≤ 40 for man	50 (17.9)
≤ 50 for women	74 (26.5)
Duration of diagnosis	
≤ 5 years	137 (49.1)
6-10 years	97 (34.8)
≥ 11 years	45 (16.1)
Duration since on medication	
≤ 5 years	148 (53.0)
6-10 years	97 (34.8)
≥ 11 years	34 (12.2)

5.4. Physical Measurements

Around two-fifth 109 (39.1%) of respondent's blood pressure were high (both SBP and DBP). Half 140 (50.2%) of the participants body weight were abnormal, above twenty-five. Abnormal waist circumference in males and females were 25 (9.0%) and 65 (23.3%) respectively (as indicated in Table 4).

Table 4: Physical measurement of hypertensive patients studied for cognitive impairment at follow up in chronic clinic, JUMC, 2018

Variables (N=279)	**Frequency (%)**
BMI (kg/m^2)	
< 18.5	15 (5.4)
18.5-24.9	124 (44.4)
≥ 25	140 (50.2)
Blood pressure (SBP/DBP)	
Normotensive	32 (11.5)
Pre hypertension	81 (29.0)
Stage I HTN	97 (34.8)
Stage II HTN	69 (24.7)
WC	
≥102cm for man	25 (9.0%)
≥88cm for women	65 (23.3%)

BMI: body mass index; DBP: diastolic blood pressure; SBP: systolic blood pressure; WC: waist circumference

5.5. Prevalence of cognitive impairment

Prevalence of cognitive impairment (CoI) was 108 (38.7%) with CI (95%CI: 33.3-44.1) among hypertensive patients (25-30 score normal and <24 had cognitive impairment). The mean ± SD MMSE score for the entire data, regardless of their educational status was 24.58 ± 4.798 (as indicated in figure 2).

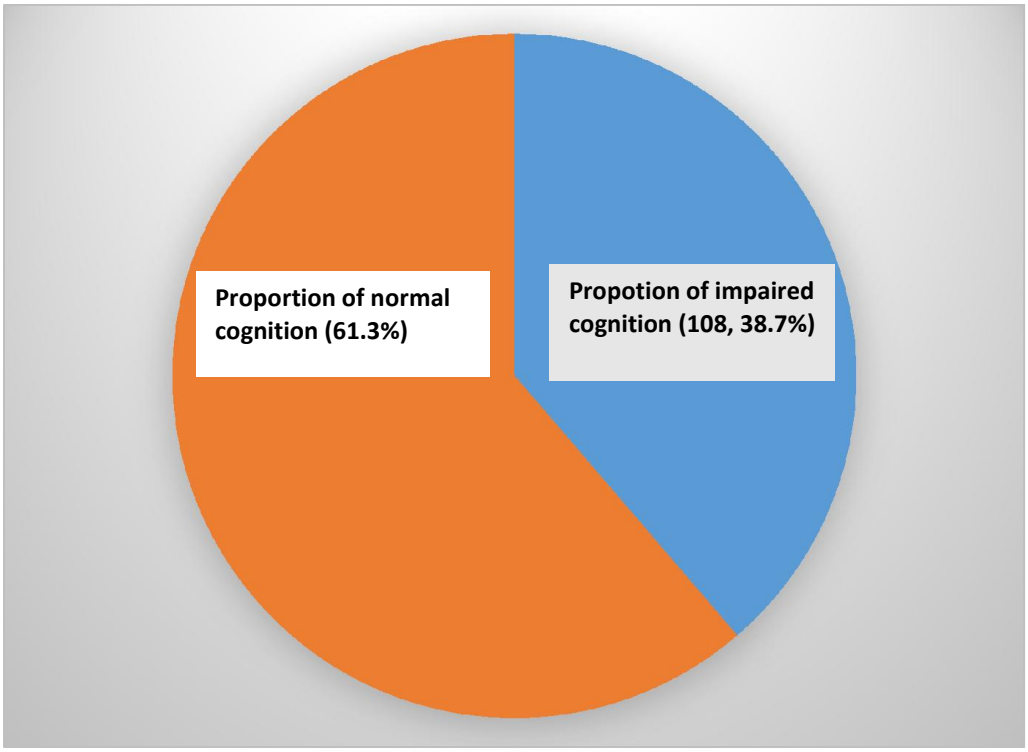

Figure 2: Prevalence of cognitive impairment of hypertensive patients studied for cognitive impairment at follow up in chronic clinic, JUMC, 2018

5.5.1. Severity of cognitive impairment

Among those who had impaired cognitive, 63 (22.5%), 42 (15.1%) and 3 (1.1%) were mild, moderate and severe their level of cognitive impairment respectively (as indicated in Figure 3).

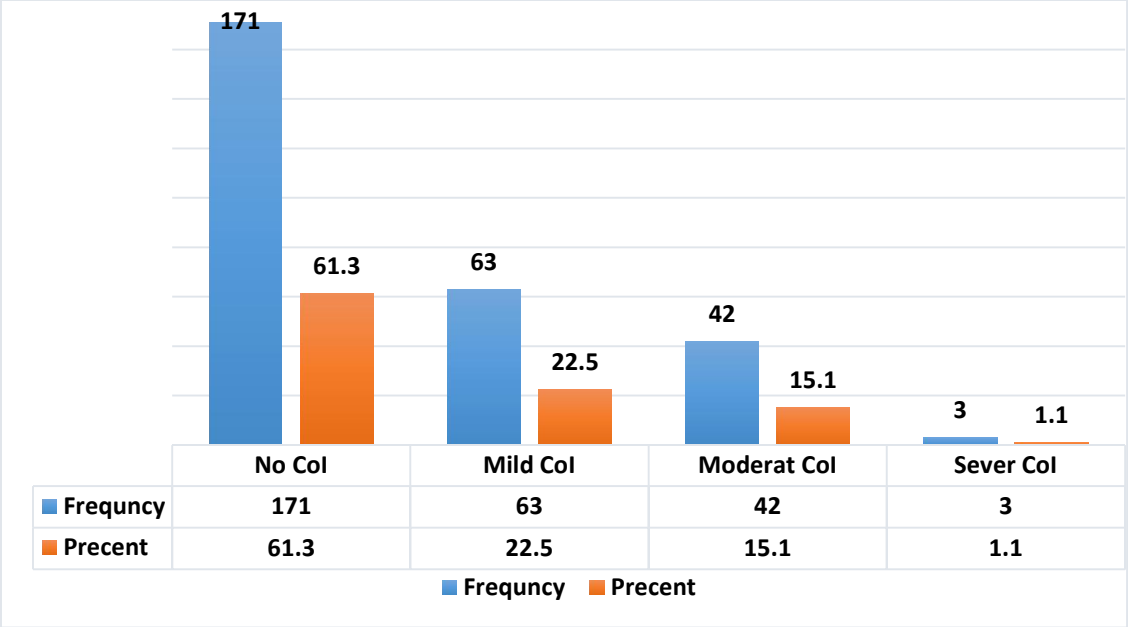

Figure 3: Prevalence severity of cognitive impairment of hypertensive patients studied for cognitive impairment at follow up in chronic clinic, JUMC, 2018,

CoI= cognitive impairment

5.6. Predictors of cognitive impairment

Table 5 shows the result of the bivariate and multivariate logistic regression analyses. In bivariate analysis, sociodemographic factors such as age group above 60 year were significantly associated with cognitive impairment (COR=2.858; 95% CI: 1.07-7.61). Additionally, being men (COR=0.618, 95% CI: 0.3-1.00) and having family history of hypertension (COR= 0.709; 95% CI: 0.41-1.20) were significantly associated with Cognitive impairment.

Among behavioral factors, Khat chewing, cigarette smoking, alcohol and coffee drinking were significantly associated with cognitive impairment (COR=0.720, 95%CI: 0.43-1.19, COR=0.497, 95%CI: 0.19-1.30, COR=0.437, 95%CI: 0.21-0.88, COR=0.324, 95%CI: 0.15-0.68 respectively). Further, physical inactivity was significantly associated with cognitive impairment (COR=0.427, 95%CI: 0.21-0.83).

The analysis of clinical related factors, cholesterol level above 240mg/dl (COR=2.091, 95%CI: 0.99-4.40), triglycerides in the middle of 151-199 (COR=1.615, 95% CI: 0.90-2.88)

and above 200 mg/dl (COR=2.837, 95%CI: 1.54-5.21) were associated with cognitive impairment. Finally, high density lipoprotein being women with less than fifty were associated with cognitive impairment (COR=0.388, 95%CI: 0.16-0.89). Although BMI, 18.5-24.9 and >25(kg/m²) were associated with cognitive impairment (COR=0.514, 95%CI: 0.17-1.53, COR=0.337, 95% CI: 0.11-1.00) respectively. Lastly HTN stage I and II was associated with cognitive impairment (COR=2.06, 95%CI: 1.06-4.02) and (COR=4.29, 95% CI: 2.11-8.69) respectively.

Hosmer lame show (p=0.732), the model was fit for Hosmer lame show. Multivariable logistic regression analysis was done for all explanatory variables having $p < 0.25$ in Bivariate logistic regression analysis However, on multivariable analysis those variable not educated, smoking cigarette, physical inactive, triglycerides $\geq$ 200mg/dl and HTN stage I and II were significantly associated with cognitive impairment.

Therefore, those who were not educated in formal education were 9.1 times more likely to have cognitive impairment than those who had Diploma and above (AOR=9.172, 95%CI: 2.561-32.851),those who had history of smoking cigarette were 4.3 times more likely to have cognitive impairment than those had no history of smoking cigarette (AOR=4.302, 95%CI: (1.106-16-734) and those who had history of physical inactive were 2 times more likely to have cognitive impairment than those were physical active (AOR=2.05, 95%CI; 1.05-5.97).In addition, those who were triglycerides $\geq$ 200mg/dl were 4.4times more likely to have cognitive impairment than those had below 150mg/dl. (AOR=4.482, 95%CI: 1.89-10.58). Finally, those who had high blood pressure corresponding to Stage I and II HTN were almost three-times and five-times more likely to had CoI than those had pre HTN (AOR=3.43,95%CI:1.498-7.871) and (AOR=5.125; 95%CI :2.052-12.802) (Table 5).

Table 5: Predictors of cognitive impairment among hypertensive patients at follow up clinic of JUMC, 2018.

Variable	Cognitive impairment		Bivariate Analysis		Multivariate Analysis	
	Yes	No	P	COR (95% CI)	P	AOR (95% CI)
Age						
20-39	8	14	1	1	1	1
40-59	51	127	0.528	0.742 (0.29-1.87)	0.681	1.30(0.36-4.72)
60+	49	30	0.036	2.858 (1.07-7.61)	0.079	3.33(0.86-12.80)
Sex						
Male	48	94	0.051	0.618(0.38-1.00)	0.556	0.78(0.31-1.96)
Female	60	77	1	1	1	1
Family history						
Yes	35	42	0.204	0.709(0.41-1.20)	0.192	1.58(0.79-3.16)
No	73	129	1	1	1	1
Khat chewing						
Yes	42	52	0.210	0.720(0.43-1.19)	0.881	0.943(0.43-2.03)
No	70	119	1	1	1	1
Cigarette smoking						
Yes	8	10	0.154	0.497(0.19-1.30)	0.035	4.30(1.10-16.73)
No	161	100	1	1	1	1
Alcohol						
Yes	12	37	0.021	0.437(0.21-0.88)	0.112	0.25(0.15-0.77)
No	96	134	1	1	1	1
Physical activity						
Inactive	24	18	0.012	0.427(0.21-0.83)	0.033	2.05(1.05-5.97)
Active	84	153	1	1	1	1

Table 5. Cont.

Variable	Cognitive impairment		Bivariate Analysis		Multivariate Analysis	
	Yes	No	P	COR (95% CI)	P	AOR (95% CI)
Cholesterol						
≤ 200	68	124	1	1	1	1
201-239	22	32	0.566	1.198 (0.64-2.22)	0.505	0.73(0.29-1.83)
≥240	18	15	0.052	2.091 (0.99-4.40)	0.185	1.79(0.71-5.56)
TG						
≤ 150	68	94	1	1	1	1
151-199	33	47	0.105	1.615(0.90-2.88)	0.119	1.96(0.84-4.59)
≥ 200	37	30	0.001	2.837(1.54-5.21)	0.001	4.48(1.89-10.58)
HDL						
≤ 40 (men)	10	40	0.346	1.312(0.74-2.30)	0.554	1.04(0.41-2.63)
≤ 50 (women)	29	45	0.026	0.388(0.16-0.89)	0.555	0.39(0.10-1.55)
Normal value	69	86	1	1	1	1
BMI (Kg/m^3)						
< 18.5	9	6	1	1	1	1
18.5-24.9	54	70	0.233	0.514(0.17-1.53)	0.922	1.61(0.41-6.26)
>25	74	93	0.051	0.337(0.11-1.00)	0.633	1.03(0.25-4.16)
BP (SBP/DBP)						
Prehypertension	34	79	1	1	1	1
Stage I HTN	36	61	0.033	2.066(1.06-4.02)	0.004	3.43(1.49-7.87)
Stage II HTN	38	31	0.000	4.290(2.11-8.69)	0.000	5.12(2.05-12.80)

6. DISCUSSION

In this study, prevalence of cognitive impairment as defined as, those who score less than 24 out of 30 point by using MMSE was 38.7% (95% CI: 33.3-44.1). This is higher than results obtained in Brazil and China, which were 23% and 15.4% respectively (43,50).This discrepancy might be due to poor blood pressure control, educational level, low HDL and institutional based study. On the other hand, this study is less than the study conducted in Peru and Iran, 63.3% and 61.5% respectively (47, 51). These differences might be due to sample size differences which was lower in our study and the fact that these two-study included co morbid diseases in contrast to our study.

In this study prevalence of mild, moderate and severe cognitive impairment was 63 (22.5%), 42 (15.1%) and 3 (1.1%) respectively. This is in line with the study done in Poland in which mild, moderate and severe cognitive impairment was 17.7%, 25.3%, and 3.3% respectively (46). In contrast the study done in Egypt 55.6% mild , 63.2% moderate, and 81.8% severe in cognitive impairment (45).This variation might be due to sample size differences and the enrolled participants' blood pressure was uncontrolled in the study done in Egypt.

On the other hand, the prevalence of the cognitive impairment increases in older age, but age groups was not significantly associated with cognitive impairment in this study, which was inconsistency with study reported in Brazil, India and Angola, where being older age was associated with cognitive impairment (43,56,62). These differences might be due to variation of age group prevalence (i.e. more than two-third of them had between 40-59 years old in this study). In this finding, those who had history of cigarette smoking were independent predictors of cognitive impairment. In line with study done in Edinburgh and London (59,77). The possible mechanism may be due to nicotine in smoking results in sympathetic nervous system and increases catecholamine's release lead to increase vasoconstriction and blood pressure, which can promote endothelial dysfunction, , thereby reduce neurogenesis and increase death of brain cells (90). but in contrast with study done in India (56), the possible reason may be due to sample size and less number of subjects in every category .

The result of this study indicate that , physical inactivity was independent predictors of cognitive impairment which were agreed with study done in Korean and Taiwan (79,80).

The possible mechanisms may be due to: physical inactive result in weight again, which in turn causes increase in activity of sympathetic nerve and arterial stiffness, this all result in heart rate and systemic vascular resistant increment, cumulative effect causes increase in blood pressure (91,92) .

In our study, participants with triglycerides above 200 mg/dl were independent predictors of cognitive impairment which were agreed with study done in Egypt and China (54,70). The possible mechanism may be due to hypertriglyceridemia changes cerebral blood vessels by increasing the viscosity of blood and lowers cognitive function by causing arteriosclerosis (93). Similarly study done in China suggest that higher normal concentrations of TG was significantly negatively associated with cognitive impairment (94).

In this study, participants with HTN stage I and II were independent predictors of cognitive impairment, which was in line with the study done in India, UK , Pittsburgh, Angola and Birmingham (56,59,60,62,71). High blood pressure alters cerebrovascular structure and function, which leads to brain lesions such as cerebral atrophy, stroke and lacunar infarcts, diffuse white matter damage, microinfarcts and microbleeds and finally results in cognitive impairment. Possible molecular mechanism of these pathology may be because high blood pressure impairs the metabolism and transfer of amyloid-β protein (Aβ), accelerating cognitive impairment (95). Damage to vascular endothelial cell function leads to a reduction of the ability of endothelial cells to regulate micro vascular flow and to exert their antithrombotic and antiatherogenic effects (96), which result in reduction of resting cerebral blood flow , which intern causes decrease in oxygen and nutrient result in impaired Aβ trafficking and promoting amyloid aggregation, finally pre-neural inflammation and death lead to cognitive loss (97).

Limitation of the study

The cross-sectional study design does not provide evidence of a cause and effect.

Lack of imaging data, confining the ability to link hypertension and its cause to neuropathology and cognitive deficits.

Undiagnosed mental illnesses and severe co- morbidity diseases might have affected the performance of the study subjects on the MMSE items, and then on the overall score.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1. Conclusions

Cognitive impairment was relatively common in our study population. Cognitive impairment accounts to about two fifth of the study population. The study revealed that cigarette smoking, physical inactivity, triglycerides above 200mg/dl and HTN stage I and II were predictors of cognitive impairment.

7.2. Recommendations

Based on our finding the following recommendations were forwarded:

JUMC should plan periodic screening of cognitive impairment among hypertensive patients to prevent further complication.

The JUMC should promote health education to the patients about physical activity and smoking to reduce risk of cognitive impairment because modifiable risk factors were identified as a predictor.

The JUMC health professionals should promote screening triglyceride ever visit to reduce risk of cognitive impairment.

The JUMC health professionals should increase the monitoring of patient's blood pressure and to reduce risk of cognitive impairment.

Moreover, Federal ministry of health should promote the implementation of strategies for screening of cognitive impairment before the development of complication.

Finally, further researcher should measure clinical factors rather than chart review, should use imaging modalities to explore extent of cognitive impairment on hypertensive patient.

REFERENCES

1. ParulKodan, Jayakumar Jeganathan STS. Medical Science Memory Impairment in Young Type 2 Diabetes Mellitus Males. *Glob Journals Res Anal.* 2014;3(6):172–3).

2. States U, Boomer B, States U. " Cognitive impairment:a call for action, Now!is available at www.cdc.gov/aging/healthybrain/index.htm'. US Dep Heal Hum Serv. *Centers Dis Control Prev.* 2010;1–4.

3. Perrotta M, Lembo G, Carnevale D. Hypertension and dementia: Epidemiological and experimental evidence revealing a detrimental relationship. *Int J Mol Sci*. 2016;17(3).

4. Shi Y, Wardlaw JM. Update on cerebral small vessel disease : a dynamic whole-brain disease.*PMC*. 2016;83–92.

5. Moser M, Roccella EJ. The Treatment of Hypertension: A Remarkable Success Story. *J Clin Hypertens*. 2013;15(2):88–91.

6. Iadecola C, Yaffe K, Biller J, Bratzke LC, Faraci FM, Gorelick PB, et al. Impact of Hypertension on Cognitive Function.*PMC*. 2016;1–29.

7. Waldstein SR. The Relation of Hypertension to Cognitive Function.*J.American Psychological Society*.2016;9–12.

8. Iadecola C, Yaffe K, Biller J, Bratzke LC, Faraci FM, Gorelick PB, et al. Impact of Hypertension on Cognitive Function.*PMC*. 2016. 68:1-29 p.

9. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, et al. Heart disease and stroke statistics-2016 update a report from the *American Heart Association. Circulation*. 2016;133(4):e38–48.

10. Patricia M Kearney, Megan Whelton, Kristi Reynolds, Paul Muntner, Paul K Whelton, He J. Global burden of hypertension--analysis of worldwide data. *Lancet*. 2005;365:217–23.

11. Kaze, Arnaud D.a; Schutte, Aletta E.b; Erqou, Sebhatc; Kengne, Andre P.d; Echouffo-Tcheugui JB. Prevalence of hypertension in older people in Africa: a systematic review and meta-analysis. *J Hypertens.* 2017;35(7):1345–52.

12. Kibret KT, Mesfin YM. Prevalence of hypertension in Ethiopia: A systematic meta-analysis. *Public Health Rev*. 2015;36(1).

13. Cha SD, Patel HP, Hains DS, Mahan JD. The Effects of Hypertension on Cognitive Function in Children and Adolescents. *International Journal of Pediatrics*.2012.

14. Felicia C. Goldstein , Allan I. Levey, and N. Kyle Steenland P. High Blood Pressure and Cognitive Decline in Mild Cognitive Impairment. *J Am Geriatic soc*.2013;61(1):67–73.

15. Elias MF, Dore GA, Robbins MA, Elias PK, Elias MF, Dore GA, et al. From Blood Pressure to Physical Disability : The Role of Cognition From Blood Pressure to Physical Disability The Role of Cognition. *J American Heart Association, Inc*.2010;1360–5.

16. Hannesdottir K, Nitkunan A, Ra C, Tr B. Cognitive impairment and white matter damage in hypertension . *Acta Neurol Scand*.2009;(13):261–8.

17. Waldstein SR, Med AB. Diagnosis of Hypertension and High Blood Pressure Levels Negatively Affect Cognitive Function in Older Adults. *Psychological Bulletin* .2005;29(13):174–80.

18. Elias MF, Goodell AL, Dore GA. Hypertension and cognitive functioning: A perspective in historical context. Hypertension. *J Hypertension*.2012;60(2):260–8.

19. Si C, Ren C, Wang P, Bian H, Wang H, Yan Z. Impairment in Preattentive Processing among Patients with Hypertension Revealed by Visual Mismatch Negativity. *BioMed Research International*.2014

20. Jennings JR, Heim AF. From Brain to Behavior : Hypertension's Modulation of Cognition and Affect.*International Journal of Hypertension*. 2012.

21. Rambe FIF and AS, Department. Correlation between hypertension and cognitive function in elderly. *Earth Environ Sci Pap*. 2018.

22. Perez-cruz C, Díaz-cintra S. Editorial : Nutrition and prevention of Alzheimer ' s disease. *J in Aging Neuro science*.2015;7.

23. Arai K, Lo EH. Astrocytes protect oligodendrocyte precursor cells via MEK/ERK and PI3K/Akt signaling. *J Neurosci Res*. 2010;88(4):758–63.

24. Guo S, Kim WJ, Lok J, Lee S-R, Besancon E, Luo B-H, et al. Neuroprotection via matrix-trophic coupling between cerebral endothelial cells and neurons. *Proc Natl Acad Sci*. 2008;105(21):7582–7.

25. Elias MF, Sullivan LM, Agostino RBD, Elias PK, Jacques PF, Selhub J, et al. Homocysteine and Cognitive Performance in the Framingham Offspring Study : Age Is Important. *Am J Epidemiol*. 2005;162(7):644–53.

26. Heron MP , Smith BL, Ed. Deaths : Leading Causes for 2003. Natl Vital Stat Reports. 2007;55(10).

27. Galloway DA, Laimins LA, Division B, Hutchinson F. Impact of Hypertension on Cognitive Function: 2016;31(3):87–92.

28. Brendan J. Kelley, MD and Ronald C. Petersen, PhD M. Alzheimer's Disease and Mild Cognitive Impairment Brendan. *PMC*. 2007;25(3).

29. Dunn KM, Nelson MT. Neurovascular signaling in the brain and the pathological consequences of hypertension. *Am J Physiol Heart Circ*.2013.

30. Spinelli C, Caro MF De, Schirosi G, Mezzapesa D, Benedittis L De, Chiapparino C, et al. Impaired Cognitive Executive Dysfunction in Adult Treated Hypertensives with a Confirmed Diagnosis of Poorly Controlled Blood Pressure. *International Journal of Medical Sciences*.2014.

31. Chalovich JM, Eisenberg E. Pathological Correlates of White Matter Hyperintensities on MRI. *Dement Geriatr Cogn Disord*.2013;31(3):477–9.

32. Elizana Petrela , Genc Burazeri , Fatjona Pupuleku , Edmond Zaimi and MR. Prevalence and correlates of hypertension in a transitional south- eastern European population: results from the Albanian demographic and health survey. 2013;2025(5):479–87.

33. WHO Regional Office for South-East Asia. Hypertension fact sheet. *Hypertension.* 2011;1–2.

34. Parkinsonism JAD, Ha H, Mustafa YH. Alzheimer's Disease and Parkinsonism. *Journal of Alzheimer's Disease & Parkinsonism*.2018;8(1):1–5.

35. Prince M, Bryce R, Albanese E, Wimo A, Ribeiro W, Ferri CP. The global prevalence of dementia: A systematic review and metaanalysis. *Alzheimer's Dement*. 2013;9(1):63–75.

36. Sosa AL, Albanese E, Stephan BCM, Dewey M, Acosta D, Ferri CP, et al. Prevalence, Distribution, and Impact of Mild Cognitive Impairment in Latin America, China, and India: A 10/66 Population-Based Study. *PLoS Med*. 2012;9(2):e1001170.

37. Lazo-Porras M, Pesantes MA, Miranda JJ, Bernabe-Ortiz A. Evaluation of cognitive impairment in elderly population with hypertension from a low-resource setting: Agreement and bias between screening tools. *eNeurologicalSci*. 2016;5:35–40.

38. Sosa-Ortiz AL, Acosta-Castillo I, Prince MJ. Epidemiology of Dementias and Alzheimer's Disease. *Arch Med Res*. 2012;43(8):600–8.

39. Mavrodaris A, Powell J, Thorogood M. Systematic reviews Prevalences of dementia and cognitive impairment among older people in sub-Saharan Africa : a systematic review. *Bull World Health Organ*. 2013;91:773–83.

40. Mulugeta Tefra DMB. Cognitive impairment among type 2 diabetes patients. *Int J Med Appl Sci*. 2013;2(3):40–54.

41. Science E. Correlation between hypertension and cognitive function in elderly Correlation between hypertension and cognitive function in elderly. *Earth and Environmental Science*.2018.

42. Leeuw F De, Groot JC De, Oudkerk M, Witteman JCM, Hofman A, Gijn J Van, et al. Hypertension and cerebral white matter lesions in a prospective cohort study. 2002.

43. Yassuda S, Moraes C, Mem CM. Hypertension Severity Is Associated With Impaired Cognitive Performance. *J Am Hear Assoc*. 2017;1–11.

44. Chaves ML, Camozzato AL, Godinho C, Piazenski I KJ. Incidence of mild cognitive impairment and Alzheimer disease in Southern Brazil. *J Geriatr Psychiatry Neurol.* 2009;22:181–7.

45. Sayed K, Taha TTI, Saad M, Mohsen LA, Ibrahiem MA, Nashaat AA. Is Mini-Mental Score Examination Scoring a New Predictor of Uncontrolled Hypertension . *The Journal of Clinical Hypertension*.2014;16(5).

46. Uchmanowicz1 ACI, Mazur G. Relation between cognitive impairment and treatment adherence in elderly hypertensive patients. *Dovepress*. 2018;1409–18.

47. Shari F, Hedayat M, Fakhrzadeh H, Mahmoudi MJ, Ghaderpanahi M, Mirare M, et al. Hypertension and Cognitive Impairment : *Kahrizak Elderly Study q.* 2012;5:212–6.

48. Haring B, Wu C, Coker LH, Seth A, Snetselaar L, Manson JE, et al. Hypertension , Dietary Sodium , and Cognitive Decline : Results From the Women ' s Health Initiative Memory Study. *American Journal of Hypertension*.2016;29.

49. Aronow WS. Hypertension and cognitive impairment. *Annals of Translational Medicine.* .2017;5(16):5–7.

50. Wu L, He Y, Jiang B, Liu M, Wang J, Yang S, et al. The association between the prevalence , treatment and control of hypertension and the risk of mild cognitive impairment in an elderly urban population in China. *journal of the Japanese Society of Hypertension*.2016; 367–75.

51. Lazo-porras M, Pesantes MA, Miranda JJ BA. Evaluation of cognitive impairment in elderly population with hypertension from a low-resource setting : Agreement and bias between screening tools. *eNeurologicalSci*. 2016;5:35–40.

52. Park H, Jo J, Cheong J, Chang H, Lee H, Suk S. Prevalence and risk factors of cerebral white matter changes and silent infarcts on brain computed tomography scans among community-dwelling healthy adults . *J Neurology Asia*.2014;19(4):351–6.

53. Yaffe K, Vittinghoff E, Pletcher MJ, Hoang TD, Launer LJ, Whitmer R, et al. Early adult to midlife cardiovascular risk factors and cognitive function. *PMC*.2014;129(15):1560–7.

54. Hashem HA* and Yasser Hamed Mustafa. Correlation between Metabolic Syndrome and Mild Cognitive Impairment. *J Alzheimer's Dis Park.* 2018;8(1):1–5.

55. Taylor C, Tillin T, Chaturvedi N, Dewey M, Ferri CP, Hughes A, et al. Midlife Hypertensive Status and Cognitive Function 20 Years Later : The Southall and Brent Revisited Study. *J Am Geriatr Soc.* 2013;1489–98.

56. Gaidhane S, Gaidhane AM, Zahiruddin QS, Khatib N. Essential hypertension and cognitive function in elderly. *Glob J Med PUBLIC Heal*. 2014;3(2).

57. Manolio TA, Olson J. Hypertension and Cognitive Function : Pathophysiologic Effects of Hypertension on the Brain. *Natl Hear*. 2003.

58. Lande MB, Kupferman JC, Adams HR. Neurocognitive Alterations in Hypertensive Children and Adolescents. *J Age Ageing*.2012;14(6):353–9.

59. Okusaga O, Stewart MCW, Butcher I, Deary I, Fowkes FGR, Price JF. Smoking, hypercholesterolaemia and hypertension as risk factors for cognitive impairment in older adults. *Age Ageing*. 2013;42(3):306–11.

60. Julie A. Suhr, Jesse C. Stewart, and Christopher R. France P. The Relationship Between Blood Pressure and Cognitive Performance in the Third National Health and

Nutrition Examination Survey (NHANES III). *Psychosom Med* 66291–297. 2004;29;291–7.

61. Leys D. Stroke occurring in patients with cognitive impairment or dementia..*Dovepress* 2016:117–21.

62. Henrique CSMuela, Valeria A Costa-Hong , Mônica S Yassuda , Natália C Moraes , Claudia M Memória, Thiago A Macedo et. al. Impact of hypertension on cognitive performance in individuals with high level of education.*J Brain and Nerves*. 2017; 1(2):1–6.

63. Gottesman RF, Schneider ALC, Albert M, Alonso A, Bandeen-Roche K, Coker L, et al. Midlife hypertension and 20-year cognitive change: The atherosclerosis risk in communities neurocognitive study. *JAMA Neurol*. 2014;71(10):1218–27.

64. Walther K, Birdsill AC, Glisky EL, Ryan L. Structural brain differences and cognitive functioning related to body mass index in older females. *Hum Brain Mapp.* 2010;31(7):1052–64.

65. Petrovitch H, White LR, Izmirilian G, Ross GW, Havlik RJ. Midlife blood pressure and neuritic plaques, neurofibrillary tangles, and brain weight at death . *Neuropsychiatric Dis Trea*.2000;21:57–62.

66. Hannesdottir K, Nitkunan A, Charlton RA, Barrick TR, MacGregor GA, Markus HS. Cognitive impairment and white matter damage in hypertension. *Acta Neurol Scand.* 2009;119(4):261–8.

67. Van Der Veen PH, Muller M, Vincken KL, Witkamp TD, Mali WPTM, Van Der Graaf Y, et al. Longitudinal changes in brain volumes and cerebrovascular lesions on MRI in patients with manifest arterial disease. *J Neurol Sci*. 2014;337(1-2):112–8.

68. Stern Y. Cognitive Reserve. Neuropsychol *PMC.* 2015;47(10):2015–28.

69. Prencipe M, Casini AR, Ferretti C, Lattanzio MT, Fiorelli M, Culasso F. Prevalence of dementia in an elderly rural population : effects of age, sex, and education.

PMC.1996;628–33.

70. He Q, Li Q, Zhao J, Wu T, Ji L, Huang G, et al. Relationship between plasma lipids and mild cognitive impairment in the elderly Chinese : a case-control study. *Lipids Health Dis*. 2016;1–8.

71. Tsivgoulis G, Unverzagt FW, Go RCP, Kissela B. Association of higher diastolic blood pressure levels with cognitive impairment.*PMC*. 2009;589–95.

72. Jr AJ, Minarik M, Jurko T, Tonhajzerova I. White coat hypertension in pediatrics. *Ital J Pediatr*. 2016;1–5.

73. Mantzoros CS, Magkos F, Brinkoetter M, Sienkiewicz E, Dardeno TA, Kim S, et al. Leptin in human physiology and pathophysiology. *Am J Physiol Endocrinol Metab* 301. 2011;

74. Barrier B, Banks WA, Coon AB, Robinson SM, Moinuddin A, Shultz JM, et al. Triglycerides Induce Leptin Resistance at the blood brain barrier. *J.America diabetic association*.2018:1253–60.

75. Holden KF, Lindquist K, Tylavsky FA, Rosano C, Tamara B, Yaffe K, et al. Serum leptin level and cognition in the elderly. *Neurobiol Aging Neurobiol*. 2017;30(9):1483–9.

76. Paz-filho GJ, Babikian T, Asarnow R, Esposito K, Erol HK, Wong M, et al. Leptin Replacement Improves Cognitive Development. *PLoS ONE* | www.plosone.org. 2008;3(8):2–8.

77. Richards M, Jarvis MJ, Thompson N, Wadsworth MEJ. Cigarette Smoking and Cognitive Decline in Midlife: Evidence From a Prospective Birth Cohort Study. *Am J Public Heal J Public Heal*. 2003;9393(6):994–8.

78. Abrous DN, Adriani W MM-F. Nicotine selfadministration impairs hippocampal plasticity. *J Neurosci*. 2002;22(3):3656–62.

79. Lee Y, Kim J, Han ES, Chae S, Ryu M, Ahn KH, et al. Changes in physical activity and cognitive decline in older adults living in the community.*PMC*. 2015;37(2).

80. Chen L-J, 1, Ku P-W, 2, Wen-Jung Sun. Associations of physical activity, insomnia and cognitive impairment in older adults. 2013;9(4):632.

81. Kirk-Sanchez1 NJ, McGough2 EL. Physical exercise and cognitive performance in the elderly : current perspectives. *Dovepress*. 2014;51–62.

82. Hailemariam S, Tessema F, Asefa M, Tadesse H, Tenkolu G. The prevalence of depression and associated factors in Ethiopia : findings from the National Health Survey. *PMC*. 2012;1–11.

83. Martinez CH, Richardson CR, Han MK, Cigolle CT. Chronic Obstructive Pulmonary Disease , Cognitive Impairment , and Development of Disability : The Health and Retirement Study.*PMC*. 2014;11(9).

84. Meade AT, Manolios N, Cumming SR, Conaghan PG, Katz P. Cognitive Impairment in Rheumatoid Arthritis: A Systematic Review.*J American College of Rheumatology*. 2018.

85. Kalungwana L, Elafros MA, Siddiqi OK, Bositis CM, Sikazwe I, Koralnik IJ, et al. Cognitive impairment and psychiatric morbidity in HIV+ Zambians with new-onset Seizure. *Am J Trop Med Hyg*. 2014;91(6):1254–8.

86. Dr Siale “Akau”ola LT. NCD Risk Factors WHO. 2014;

87. Mitchell AJ, Shukla D, Ajumal HA, Stubbs B, Tahir TA. The Mini-Mental State Examination as a diagnostic and screening test for delirium: Systematic review and meta-analysis. G*en Hosp Psychiatry*. 2014;36(6):627–33.

88. Lawes CMM, Bennett DA, Feigin VL, Rodgers A. Blood Pressure and Stroke. *Lancet Neurol*.2004;776–85.

89. Waldstein SR, Brown JRP, Maier KJ, Katzel LI. Diagnosis of hypertension and high

blood pressure levels negatively affect cognitive function in older adults. *Ann Behav Med*. 2005;29(3):174–80.

90. Petoud S, Muller G, Moore EG, Xu J, Sokolnicki J, James P, et al. Inhibition of Endothelial Nitric Oxide Synthase by C-Reactive.*PMC*. 2009;129(1):77–83.

91. Rahmouni K, Correia MLG, Haynes WG, Mark AL. Obesity-Associated Hypertension. *Am Hear Assoc Inc*. 2004;9–14.

92. Li qin, Eva Corpeleijn, Chaoqiang Jiang. Neil Thomas, C. Mary schooling, Zhang, Kar Keung Cheng, Gabriel M. Leung, Ronald P. Stolk, Tai Hing Lam M. Physical Activity, Adiposity, and Diabetes Risk in Middle-Aged and Older Chinese Population. *Diabetes Care*. 2010;33(11).

93. Koenig W, Sund M, Ernst E, Mraz W, Hombach V, Keil U. Association between rheology and components of lipoproteins in human blood.*PMC*.1992;85(6):2197–204.

94. Studies D, Road C, District C. High normal plasma triglycerides are associated with preserved cognitive function in Chinese oldest-old. *J.Oxford age and agining*.2012:600–6.

95. Tracy RP, White LR, Launer LJ. Midlife blood pressure, plasma β amyloid and the risk for Alzheimer's disease. *PMC*. 2013;59(4):780–6.

96. Faraci FM. Protecting against vascular disease in brain. *Am J Physiol Hear Circ Physiol.* 2011;1081:1566–82.

97. Poggesi A, Pasi M, Pescini F, Pantoni L, Inzitari D. Circulating biologic markers of endothelial dysfunction in cerebral small vessel disease : A review. *J Cereb Blood Flow* Metab. 2016;36(1): 72–9.

APPENDIXES

I. Patient Written Consent Form

My name is Tesema Etefa from College of Medical science Jimma University, Department of Biomedical science. The Purpose of this study is to determine the prevalence and predictors of cognitive impairment among hypertensive patient having a follow up at chronic ambulatory clinic at JUMC. Your participation is important for the success of this research. This study will help to know the extent of modifiable risk factors as well the nature of cognitive impairment. The scientific knowledge and evidences obtained from these studies will contribute to the improvement of health and quality of life of hypertension. The study will provide data that will strength treatment and improve quality of hypertension

To achieve all these research objectives your cooperation and involvement is crucial. The information you provide will not affect the service you get from the institution; the confidentiality of your information will be kept securely and only used for this research purpose. Your name, address and personal detail that leads to personal identification will not be included in the data collection process. You have the right not to participate in this study, not to allow review of your medical record, to skip any question you are not interested to answer and withdraw from the research at any time.

If you agree to participate in this study, we will ask questions concerning risk factors for hypertension. We will also take weight, height, waist and blood pressure measurements.

Knowing the objective of the study and the data collection process, I am happy and acknowledge your voluntariness to be part of this research.

I understand and agreed to participate in the study

Participant Unique ID No. _____

Date_____Month_____Year_____

_

Data Collector Name and Signature :---------- Date---------- Month----------Year: _____

Thank you for your cooperation

Email: tesemaetefa743@gmail.com**Phone number: 0920152727**

II. Data collection tool

Prevalence and predictors of cognitive impairment among hypertension patient: a cross-sectional study

Data Collector Name		Participant Unique No：
Supervisors Name		
	Mobile Phone：	

	Sociodemographic Information	
Q.01	Age	_____
Q.02	Sex	1. Male 2. Female
Q.03	Religions	1. Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Others
Q.04	Ethnicity	1. Oromo 2. Amhara 3. Kaffa 4. Tigrey 5. Gurage 6. Others
Q.05	Residence	1. Urban 2. Rural

Q.06	Educational status	1. Illiterate 2. Read and write only 3. Grade 1-4 4. Grade 5-8 5. Grade 9-10 6. Grade 11-12 7. Diploma 8. BSC and higher
Q.07	Marital status	1. Single 2. Married 3. Widow 4. Divorced/Separated
Q.08	Current occupation	1. Unemployed 2. Employed 3. Merchant 4. Farmer 5. Government official 6. Daily laborer 7. Others
Q.09	Income	_____
Behavioral related factors		
In the past two months		
Q.010	Khat chewing	1. Yes 2. No
Q.011	If yes Frequency of Khat chewing	1. Rarely 2. Occasionally 3. Some times 4. Always
Q.012	Cigarette smoking	1. Yes

		2. No
Q.013	If yes frequency of smoking	1. Rarely 2. Occasionally 3. Some times 4. Always
Q.014	Alcohol	1. Yes 2. No
Q.015	If yes frequency of alcohol	1. Rarely 2. Occasionally 3. Some times 4. Always
Q.016	Coffee /tea	1. Yes 2. No
	If yes frequency of coffee/tea	1. Rarely 2. Occasionally 3. Some times 4. Always
Q.017	Physical activity	_____ min/hours
	Diet	
Q.018	How many days do you eat fruit?	Number of days_____ If Zero days, go to
Q.019	How many servings of fruit do you eat on one of those days?	Number of servings
Q.020	How many days do you eat vegetables?	Number of days_____ If Zero days, go to
Q.021	How many servings of vegetables do you eat on one of those days	Number of servings

Q.022	What type of oil or fat is most often used for meal preparation in your household?	1. Vegetable oil 2. Lard or suet 3. Butter or ghee 4. Margarine 5. Other 6. None used 7. Don't know
	Clinical related factors	
Q.023	**Fasting blood glucose**	
Q.024	During the past two weeks, have you been treated for raised cholesterol with drugs (medication) prescribed by a doctor or other health worker? 1. Yes 2. No	
Q.025	Total cholesterol (TC)	
Q.026	Triglycerides (TG)	
Q.027	High-density lipoprotein (HDL)	
Q.028	Low-density lipoprotein (LDL)	
Q.029	Family history of HTN	1. Yes 2. No
Q.030	BMI	_____
Q.031	Duration of Hypertension since Diagnosis	_____
Q.032	Starting medication	1. Yes 2. No
Q.033	Duration Since on medication	_____

Standardized mini-mental state examination for cognitive assessment (write the score)

	Types of questions	score	T/s	Types of questions	score	T/s

Q.034	What year is this?	__/1	10	What country are we in	__/1	10
	What season is this	__/1	10	What region are we in	__/1	10
	What date is this?	___/1	10	What town are we in	___/1	10
	What day is this?	___/1	10	What is the name of this hospital?	___/1	10
	What month is this	___/1	10	What floor of the building are we on?	___/1	10
Q.035	I am going to name three objects. When I have finished, I want you to repeat them. Remember what they are because I am going to ask you to name them again later : **Bag / key/ arm** [score out of three]				___/3	10
Q.036	"I would like you to count backward from 100 by sevens." (93, 86, 79, 72, 65)				___/5	10
Q.037	What were the three objects I asked you to remember? (score one point for each correct answer regardless of order)				__/3	10
	Show wristwatch. What is this called?				__/1	10
Q.038	Show pencil. What is this called				__/1	10
Q.039	I would like you to repeat a phrase after me: No ifs, ands or buts?				__/1	10
Q.040	Read this and then do what it says. Then, hands the person the sheet with **CLOSEYOUR EYES** on it. If the participant just reads and does not close eyes, you may repeat to a maximum of three times. Score one point only if the subject closes eyes.				__/1	10
Q.041	Hand the person a pencil and paper Say: Write any complete sentence on that piece of paper. The sentence must make sense. Ignore spelling errors				__/1	10

Q.042	Place design, eraser and pencil in front of the person. Say: Copy this design please. Allow multiple tries. Wait until the person is finished and hands it back. Score one point for a correctly copied diagram. The person must have drawn a four-sided figure between two five-sided figure 		__/1	10
Q.043	Ask the person if he is right or left handed. Take this paper in your right/left hand (whichever is non-dominant), fold the paper n half once with both hands and put the paper down on the floor	Take paper in correct hand	__/1	30
		Folds it in half	__/1	
		Puts it on the floor	__/1	
		Total score	30	5m,10se

NB- T=time, S=seconds, min= minutes

PART VIII: Physical Measurements		
	Blood Pressure	Response
Q.053	Reading 1._____	Systolic (mmHg)-
	2._____3._____	Diastolic (mmHg)-
	Height and Weight	
Q.054	For women: Are you pregnant?	1. YES if yes stop here 2. NO
Q.055	Height	in Centimeters (cm):-

Q.056	Weight	in Kilograms (kg):-
	WAIST	
Q.057	Waist circumference	in centimeters (cm):

III. Patient Information sheet Afan Oromo Version

Odeefannoo Hirmaataa

Maqaa Qorataa: Tassaamaa Itafa

Bakka qorannoo: Hospitaalaa medikalaa Jimmatti

Baasii qorannoo Kan haguugu: yuuniversiitii Jimma

Kaayyoo qorannoo: Hospitaalaa Medikalaa Jimmatti dhuukkubsattota deddeebbidhaan yaalamanirraa hamma faca'insa fi agaarsiistuu dhukkuba yaadduu dadhabuu dhukkubsaatootaa dhibbaa dhigaa qabaan keesssaati addaa baasuu taha.

Haala adeemsa qorannoo: qorannoo kanarratti akka hirmaattaniif isin affeeraa fedha yoo qabaattan qofa waliigaltee qophaa'e hubattanii malatteesitu. Jalqabarratti odeeffanoo hawaasummaa itti aansuun waa'ee wantootaa amaalaan yookiin araadaa waaliin wal qabaatan, amaloota isaan faana hidhata qaban kan akka sochii qaamaa, sirna sooratаa, hamma alkoolii fi sigaaraa aarsuu irratti Kan xiyyeeffatani gaafatamtu.akkasumaas

Waantootaa faayyaa isaaanii waliin waal qabaataan Sanaan booda hamma dhiibbaa dhiigaa, Ulfaatinaa fi dherinaa ni safarra. Achiin boodaa qoraanoo haalaa dandeetti yaadduu isaa ittin madaalamuu fi haalaa Hirribaa gariin ittin maaadalamuu ni gafatamaa dhumaa irratti Bu'aa qorannootiin yoo isinirratti argame ogeessa isin yaalutti agarsiisuun akka yaalamtan ni ta'a.

Rakkoo qorannootiin dhukkubsatootarra ga'u: qooranicharratti hirmaachuutiin rakkoon isinirra ga'u hin jiru.

Mirga qoranicharratti hirmaachuu dhiisuu yookiin erga jalqabanii addaan kutuu: qoranichi fedhii guutuu hirmaataa irratti kan hundaa'eedha. Qoranicharratti hirmaachuuf dirqama hin qabdani. Gaaffii hin barbaannee dhiisuu ni dandeessu. Akkasumas qoranicha irratti hirmaachuu dhiisuu keessaniitiin tajaajila fayyaa hin dhabdan yookiin rakkinni kamiyyuu isinirra hin ga'u.akkasumas yeroo barbaddanitti qoranicharraa addaan kutuu dandessu.

Qoranicha irratti Hirmaachuun faayida inni qabu: dhukkuba yaadduu dadhabuu dhukkubsaatootaa dhibbaa dhigaa qabaan keesssaati mula'ataan haala kaamiin akkaa dhufuu akkasumas haalaa kamiin akka of irraa ittistaan ni baraatuu.

Fayidaa: dhukkubsataa galateefachuun ala hirmaachuudhaaf kaffaltiin addaa hin kennamu.

Iciitii: qoorannoo kanarraa kan argamu odeeffanoon kamiyyuu iciitiin isaa ni eegama. Maqaan hirmaataa odoo hin caafamiin hirmaataa hundaafuu lakkofsi eeyyummaa ni kennama. Kanas qorataa fi ogessa fayyaa ala namni beekuu hin jiru.

Odeeffannoon qorannicharraa argamus iciitiin isaanii ni eegama. Ofeeggannoon itti cufamee dursaa qorataan bakka hin sakkisiisne ni kaayama.

Waliigaltee: qoranicharratti hirmaachuuf dhukkubsatichi walii galtee guutuu gochuu qaba.Qoranicharratti yaadaa fi gaaffiif: qoranicharrati yaada barbaadaniif teessoo kanaa na dubbisuu dandeessu. Yeroo keessaan Arsaaa gootaanii waan qoraanichaa irraati hirmaataanif galatoomaa

Faca'insaa fi agarsisituu dhukkubaa yaaduu dadhabuu namootaa dhukkubaa dhibaa dhigaa qabaan keessaatti mula'aatan

Kutaa I : **oddeefaannoo Hawaasumaa fi haalaa dhunfaa namaa**		
Q.01	Umrii(waggadhaan)	_____
Q.02	saala	1. Dhiiraa 2. Dhalaa
Q.03	Amantaa	1. Orthodoksii 2. Muslimaa 3. Protestantii 4. Katoolikii 5. Kan biroo adda baasi----------
Q.04	sabaa	1. Oromoo 2. Amharaa 3. Kaffaa 4. Tigreyee 5. Guraagee 6. Kan biroo adda baasi----------
Q.05	Iddoo Jireenyaa	1. Magaalaa 2. Baadiyaa
Q.06	Sadaarkaa barumsaa	1. kan hin baraanee 2. Bareessuuu fi dubbisuu kan danda'uu qofa

		3. Kutaa 1-4 4. Kutaa 5-8 5. Kutaa 9-10 6. Kutaa 11-12 7. Diploomaa 8. Digirii fi isaa oli
Q.07	Haalaa fuudhaa fi Heerumaa	1. Kan Hin fuunee 2. Kan fuudhee 3. kan irraa du'ee/duutee 4. Kan garagar bahaan
Q.08	Gosaa Hojii	1. Kan hojii hin qabnee 2. Hojeetaa 3. Daaldaalaa 4. Qootee Bulaa 5. Hojii mootumaa kan hojeetuu 6. Hojeetaa Guyyaa 7. Kan biro addaaa baasii----------
Q.09	Gaalii Ji'aa meeqaa?	_____
Kutaa II**: wantootaa amaalaan wal qaabataan**		
Q.010	Chaatii ni qaamtuu	1. eeyyee 2. Laakki
Q.011	Gaaffiin Q.1010 Eeyye yoo tahee yeroo baay'ee ni qaamaatuu?	1. Xiqqoo xiqqoo 2. Darbee 3. Yeroo tokko tokko 4. Yeroo hundaa
Q.012	Sigaaraa ni Xuuxuu ?	1. Eyyee 2. lakkii
Q.013	Gaaffiin Q.1013 Eeyye yoo tahee yeroo baay'ee ni Xuutuu?	1. Xiqqoo 2. Darbee 3. Yeroo tokko tokko

		4. Yeroo hundaa
Q.014	Alkoolii ni dhugduu?	1. Eyyee 2. Laakki
Q.015	Gaaffiin Q.1014 Eeyye yoo tahee yeroo baay'ee ni dhugduu?	1. Xiqqoo xiqqoo 2. Darbee 3. Yeroo tokko 4. Yeroo hundaa
Q.016	Bunaa /shayyii ni dhugduu?	1. Eeyyee 2. Laakkii
Q.017	Gaaffiin Q.1016 Eeyye yoo tahee yeroo baay'ee ni dhugduu?	1. Xiqqoo xiqqoo 2. Darbee darbee 3. Yeroo tokko 4. Yeroo hundaa
Q.018	Sochii qaamaa ni Gotuu?	_____ Daaqiiqadhaan/sa'atiidhaan
Kutaa III**: Haalaa nyaataa**		
Q.019	Nyaataa fudhuraa torbaaniti guuyyaa meeqaa fayyaadamtaa?	Baay'innaa guyyaa _____
Q.020	Guyyootaa fayaadamtuu kanaa keessaati fuduraa yeroo meeqaa fayyadamtaa?	Guyyaati yeroo meeqaa akka fayyadamuutan----------
Q.021	Nyaaataa muuduraa torbaanitii guyyaa meeqaa fayyadamtaa?	Baay'innaa guyyaa _____
Q.022	Guyyootaa fayaadamtuu kanaa keessaati muduraa yeroo meeqaa fayyadamtaa?	Guyyaati yeroo meeqaa akka fayyadamuutan----------
Q.023	Manaa keessaati nyataa qopheefachuuf gosaa zaayitaa kaam fayyadamtuu?	1. Zaayitaa muduraa irraa hojeemee 2. Dhadhaa 3. Margarine 4. Kan biroo addaa baasii----------

		5. Hin fayyadamnuu 6. Hin beekuu
Kuutaa IV: waantootaa kiliinikaa waal qabaataan		
Q.024	Glukoosii qaamaa keessaa hangami	_____
Q.025	Torbaan laaman duraa sabaabaa kooleestirroliin qaamaa kee olka'ee qoorichaa doktoraan yookiin ajaajeen yaalamtee 1. Eeyyee 2. Laakkii	
Q.026	Koolestiroolii waalii gaalaa	
Q.027	Triglyceraayidii	
Q.028	Ruukinii lipoo prootini guudaa kan tahee(HDL)	
Q.029	Rukkini lipoo prootini xinnaa kan tahee (LDL)	
Q.030	maatii keessaa kan dhukkubaa dhibbaa dhigaan qabamee jiraa?	1. Eyyee 2. Lakkii
Q.031	BMI/ ulfaatinii qaamaa isaa yoo dheerinaa isaa hiraamuu	_____
Q.032	Dhibbaaan dhigaa ergaa beekaamee hangaamii?	_____
Q.033	Dhukkubaa dhibbaa dhigaatiif qorichaaa jalqabeee ?	1. Eeyye 2. Lakkii
Q.034	Dhukkubaa dhibaa dhigaatiif qorichaaa jalqabeee	_____
Q.035	Gosaa qorichaa jalqaabee maali inni?	_____

Kutaa VI: Standardii qoraanoo haalaa mini-mental state for cognitive assessment (write the score)

Q.036	Gosaa gaaffillee	___/1	Qabxii walii galaaa	Gosaa gaaffillee	qabxii	Qabxii walii galaaa
	Waggaan kun maalii?	___/1	10	Biyyi nuti keessaa jiraanuu maaii?	__/1	10
	Ji'aa keessaa jiruu maalii?	__/1	10	Naaannoon nuti keessaa jiraanuu maalii?	__/1	10
	Guyyaan Haraa meeqaa?	___/1	10	Maagaalan nuti keessaa jiraanuu maalii	___/1	10
	Guyyaan har'aa maalii?	___/1	10	Maaqaan hospital kanaa maalii?	___/1	10
	Ji'ini kun maali	___/1	10	Sadaarkaaan fooqii nuti irraa jiruu meeqaa?	___/1	10
Q.037	Maaqa waantootaa saadi maqaan dha'aa ,ergaan ani tumuree ati immoo irraa deebitee waamtaa sirritti xiyyeeefaadhuu boodaa waaanan si gaafadhuuf : boorsaa / Quulfii/ harkaa [qabxii waali gaalaa sadii keessaa]				___/3	10
Q.038	"100 irraa qabdee garaa duubaati torbaa irraa hir'isaa naati himtaa?" (93, 86, 79, 72, 65)				___/5	10
Q.039	Waantootni ani waaan sadi yaamee yaadaadhuu sin jedhee maal fa'ii? (tokko tokkon deebi qabxii tokko qabuu)				__/3	10
Q.040	Bakkaa sa'aati itti hidhaatan naati agaarsiisi				__/1	10
	Irsaasii naati agrsissi.				__/1	10
Q.041	Jechaa kanaa dhageefadhuu irraa deebitee jeetaa: yoo tahee ni taha, yoo hin				__/1	10

	tanee hin tahuu?			
Q.042	Isaa armaan gadii kana dubbisi waan inni jedhuu hojeedhuu. , namaa harkaa qabi ,waaraqaadhaan ijaa isaa dhoksi. Yoo dubbisee fi ijaa isaaa yoo cuufuu baatee yeroo saadi irraa deebii.qabxii kan argaatuu yoo ijaa cufee qofaa.		__/1	10
Q.043	Namicha irsaasaa fi waarqaa itti keeni :akkaa inni waarqaa irraatti jechaa hiikaa qabuu kaamiyyuu yaa tahuu akkaa barreessuu ajaajii : jechichaa yoo qubeen illee sirrii tahuu baatee rakkoo hin qabuu		__/1	10
Q.044	Dizaayiinni, Irsaasii fi Haqtuu namichaa fulduraa itti keenni akkaa inni diizaayinii sanaa kaasuu ajaajii. Yaalii yeroo dheeraa akkaa inni godhuu eeyyaamifi, akkasumaa hangaa inni hojiichaa xumuruti obsi. Yoo seeraan diizaayinichaa kaasee qabxii tokkoo keeniifi 		__/1	10
Q.045	Naamni ati gaaffi gaafaatuu Harkaa mirgaa yookiin bitaa tahuu gafadhuu. Kanaa boodaa waraaqaa akkaa inni harkaa mirgaa fi bitaan kaasuu godhi (kaamtuu irraa caalaa kaasee?) itti ansuun waaraqaa akkaa inni harkaa lamaanin akkaa inni mammaaaree lafaaa irraaa ka'uu ajaaji	Waraaqa yoo seeraan fuudhee	__/1	30
		Waarqichaa yoo waalakaa isaa maammaree	__/1	
		Waaraqichhaa mammaree yoo laafaa irraa ka'ee	__/1	
	Qabxii waalii gala		30	5m,10se

NB- T=time, S=seconds, min= minutes

Kutaa VIII: Physical Measurements		
	Dhibbaa dhigaa	deebii
Q.055	saafaraa 1ffaa._____ 2ffaa._____3ffaa._____ _	Systolic (mmHg)- Diastolic (mmHg)-
Q.056	Torbaan saadeen darbaan keessaa dhibbaa dhigaa olka'eef qorichaa dooktori yookin oogeessi faayyaa siif ajaajeen yaaalamtee beektaa	1. Eeyye 2. lakki
	Dheerinaa fi ulfaatinaa	
Q.057	dubartootaaf: dubartii ulfaati?	1 Eeyyee yoo Eeyye tahee asumaaati dhaabi 2 lakki
Q.058	dheerinaa	seentimeetiraan (sm):-
Q.059	Ulfaaatinaa	Kilogramiidhan (kg):-
	Mudhii	
Q.060	Naannaawaa mudhii	seentimeters (sm):
Q.061	Dhahaanaa onnee	safaaraa 1._____ 2. _____3._____