

CHAPTER ONE

INTRODUCTION

1.1 Background

The World Health Organisation (WHO, 2004) estimates that there are about 2 billion people worldwide who consume alcoholic beverages and 76.3 million with diagnosable alcohol use disorders. Alcohol consumption, especially in large quantities may result in intoxication (drunkenness) and alcohol dependence. The volume of alcohol consumed and the pattern of drinking are reported to be pertinent factors in the health outcome of the drinking population (WHO 2004).

Alcohol dependent patients according to the DSM–IV criteria exhibit the incapability to control substance use and keep up important social, occupational or recreational activities (Kaplan, Sadock and Sadock 2007).

Alcoholics are excessive drinkers whose dependence on alcohol results in noticeable mental disturbance or interference with their mental and bodily health, interpersonal relations and their smooth social and economic functioning, or who show the prodromal signs of such developments (Mangal, 2005).

Moderate or social drinking on the other hand, is understood to mean consuming an average of one drink per day or consuming alcohol on special occasions such as at parties (Pippin and Varnes, 1995, p 483). This means that moderate alcohol consumers do not drink to an extent that they would be classified as alcoholics as has been defined in the preceding paragraph.

Moderate alcohol consumption is a relatively common practice and recommendations on what has been termed as ‘sensible drinking’ have been established by public health bodies, medical associations and Non-governmental Organisations such as the World Health Organisation (WHO). These guidelines are issued by government and public health entities to advise on levels of alcohol consumption that are considered ‘safe’, responsible, or low risk (WHO, 2004). Official standard drinks or units generally contain between 8 and 14 grams of pure ethanol

although the measure may vary among countries. Notwithstanding, it is still a useful tool because although strengths of different types of alcohol vary significantly, using the standard measure allows for uniformity. Thus in terms of the alcohol content, a standard drink/unit will be more or less the same regardless of whether it contains beer, distilled spirits, wine or a mix of the beverages (WHO, 2004).

The World Health Organisation (2004), reports that the acceptable measures for moderate alcohol consumption are: 21 units for males and 14 units for females per week, and 4 units for males and 3 units for females per day.

Kaplan, Sadock and Sadock (2007), note that a good understanding about the effects of alcohol is vital in health care practice especially with cases regarding alcohol related disorders. This is important as excessive alcohol consumption can have various health consequences especially neurological problems. One identified problem associated with long-term heavy alcohol use is Wernicke's encephalopathy, which is characterized by neurological problems such as global confusional state, ophthalmoplegia, nystagmus, ataxia and polyneuropathy. Another condition associated with alcohol abuse is alcoholic Korsakoff syndrome which is characterized by significant memory impairment. It is characterised with an onset of severe thiamine deficiency which when combined with alcohol consumption may result in the acute death of cells in the basal forebrain and a subsequent loss of cholinergic input to the cortical and limbic structures involved in memory (Ibid).

It is also well established that alcohol-induced cognitive impairments for heavy drinkers ranges from mild to moderate deficits in neuropsychological testing to severe disorders of alcohol-induced persisting amnesia disorders such as Korsakoff syndrome and alcohol-induced dementia (Scheurich, 2004).

The present study examines the relationship between moderate alcohol consumption and cognitive functioning. Cognitive functioning refers to mental processes such as thinking, knowing and memory. Cognition allows us to engage ourselves in selective attention, perception and decision making (Kassin, 1998).

In looking at the relationship between alcohol consumption in moderation and cognitive functioning, the current study is also taking into account views held by scholars such as Lindstrom (1992), who suggests that terms such as ‘alcoholic’ and ‘alcohol abuser’ may be misleading as they seem to support an incorrect assumption that there exist clear set limits on what would be classified as harmful and harmless consumption of alcohol. They much rather support the idea that virtually all alcohol consumption has potential effects related to it that require investigation (Lindstrom, 1992, p. 61).

1.2 Prevalence of alcohol consumption

Kaplan, Sadock and Sadock (2007), in trying to elucidate the prevalence of alcohol consumption, report that consuming alcoholic beverages is generally considered an acceptable and common habit. It is estimated that of the 90% of all United States residents who have had an alcohol containing drink at least once in their lives about 51% are still currently consuming alcohol. They also note that different groups have been observed to have different drinking patterns. It has been observed that groups with high education and high socio-economic status are amongst the highest proportion of people who currently drink. Amongst religious groups, the Jews have been observed to have the highest proportion of current alcohol consumers but the lowest number of people with alcohol dependency.

Kaplan, Sadock and Sadock (2007) further observe that in The United States of America, at some time during life, 90% of the adult population report having occasionally consumed alcohol, with the majority beginning their alcohol intake in the early to middle teens. It has also been reported that by the end of high school, 80% of students have consumed alcohol. Additionally, two out of three men are drinkers with the ratio of persisting alcohol intake of approximately 1.3 men to 1.0 women with the highest prevalence of drinking occurring amongst the middle teenagers to those in their mid-20s. It has also been noted that out of these, 30-40% have had at least one transient alcohol induced amnestic episode such as a blackout, driving a motor vehicle while intoxicated, or missing school or work because of consuming alcohol. These statistics further show that persons who are involved in automobile accidents do not always meet the diagnostic

criteria for an alcohol related disorder. This in itself shows that the majority of the population falls in the social or moderate drinking category.

Drunken drivers are involved in about 50% of all automotive fatalities (Ibid 2007 p. 360). The World Health Report (2004) has published similar estimates for Zambia. It is estimated that road fatalities involved 50% of drinking drivers, 33.3% cyclists and 31.1% pedestrians most of whom are below the age of 30.

1.3 Statement of the problem

The statistics presented above shows the prevalence of social/moderate alcohol consumption and how it tends to affect everyday activities.

As much as there are different drinking patterns, there are also variations in the types of alcoholic beverages consumed. In Zambia, according to the World Health Report (2004), lagers or bottled beers, are mostly preferred by working men and male university students. This beverage is most associated with persons with a secure socio-economic status. Low socio-economic status individuals tend to consume opaque beer also known locally as Chibuku, which has commercial versions such as shake-shake. It is brewed from grain and has an alcoholic content of 3%. Another common alcoholic beverage among low-economic status individuals is a distilled spirit known locally as Kachasu made mainly from sorghum and maize it is home brewed using water, sugar and yeast and is ready for consumption within 24 hours.

Furthermore, it has been observed that in Zambia, social drinking is widely accepted and has even been incorporated into many important ceremonies. Zambia is said to be amongst nations with the highest levels of drinking in Africa (Haworth, Mwanalushi, and Todd. 1981, www.afrikano/Detailed/). It has also been noted that alcohol is not thought of as a drug because of its use for cultural and social purposes. This could explain why despite efforts by The Drug Enforcement Commission (DEC) through its National Educational Campaign Divisions to reduce the demand for substance abuse it has nevertheless, been observed that alcohol use is on the increase surpassing all other drugs (www.beerdrinking.info).

Given the prevalence of alcohol use in Zambia and its related consequences, it was deemed necessary that an investigation be instituted in this area with regard to how social drinking impacts on cognitive functioning. This would be useful in determining the premorbid cognitive functioning of individuals who consume alcohol in moderation when they seek neuropsychological assessment.

1.4 Study justification

As has been outlined in this paper, moderate alcohol consumption or social drinking in Zambia is relatively widespread (WHO, 2004, www.beerdrinking.info). In the advent of Zambia making major strides towards attaining more holistic and better medical services, it is imperative that all aspects that have a bearing on better health service delivery be understood. Neuropsychological testing is one such major step toward better health service delivery.

Considering that cognitive functioning is one of the key components measured in neuropsychological tests, there is need to understand the various factors that are associated with cognition more fully. One such salient factor related to cognitive functioning is alcohol consumption in moderation. Findings in this area will indeed be beneficial to Neuropsychologists as they seek to analyse and interpret test results from the administered neuropsychological tests, ultimately improving health service delivery.

1.5 Research objectives

General objectives

To investigate the relationship between moderate alcohol consumption, and cognitive functioning.

Specific objectives

- To determine whether there is a difference in the cognitive functioning of moderate alcohol consumers and non-drinkers.
- To ascertain whether there are gender differences in the way alcohol is related to cognitive functioning.

- To find out if moderate alcohol consumption has different cognitive outcomes across different age groups.
- To find out if the frequency of alcohol consumption affects cognitive functioning.

1.6 Operational definitions

- *Cognitive functioning.* (As measured by performance on the Zambia Neurobehavioural test battery);
 - ❖ Working Memory, based on performance on the Paced auditory Serial Addition Test and WMS-III Spatial Span.
 - ❖ Verbal Fluency, based on performance on Noun, verb and sound fluency.
 - ❖ Speed of Information Processing, based on performance on WAIS III- Digit Symbol, WAIS-III Symbol Search, Trail Making Test A, Colour Trails (CTT) Trails 1 and Stroop Colour and Word Test- Colour Trails.
 - ❖ Learning and Delayed Recall based on performance on Hopkins Learning Test– Revised and Brief Visuospatial Memory Test–Revised.
 - ❖ Executive functioning based on performance on The Wisconsin Card Sorting Test, Computer Version-2, Halstead Category Test, Colour Trails 2 and Stroop and Word Test-Colour/Word Trails.
 - ❖ Motor Speed and Dexterity based on performance on the Grooved Pegboard Test.
- *Gender*
 - ❖ Male
 - ❖ Female
- *Age group* stands for the following
 - ❖ 20-35 years
 - ❖ 36-45 years
 - ❖ 46-56 years

- *Frequency of consumption* means consumption on the following basis
 - ❖ Daily
 - ❖ Weekly
 - ❖ Monthly

- *Quantifying of Alcoholic Units*
 - ❖ The units consumed should fall in the range of:
 - 21 units per week /4 units per day for males
 - 14 units per week /3units per day for females, to qualify as moderate consumption.

Alcohol units for the common types of alcoholic beverages consumed in Zambia (these are to be taken as averages)

<u>BEVERAGE</u>	<u>ALCOHOL CONTENT</u>	<u>UNITS</u>
Bottled Beer	4.4	3
Opaque Beer	3.0	5
Mbamba	6.9	3
Kachasu	20.0	9
Euro	40.0	2

Haworth, Mwanalushi, and Todd (1981).

1.7 Variables

- *Dependent Variable;*
 - ❖ Cognitive functioning

- *Independent Variables;*
 - ❖ Gender
 - ❖ Age range
 - ❖ Alcohol consumption
 - ❖ Frequency

1.8 Theoretical background

Butters and Granholm in Parsons, Butters and Nathan (1987) outline the continuity hypothesis which was postulated by Ryback in 1971. Ryback suggested that there is a continuum of cognitive impairment with the alcoholic Korsakoff patient occupying one end of this spectrum and heavy social drinker occupying the other end.

The continuity hypothesis thus predicts that a given individual's degree of cognitive deficit is determined by his or her drinking history as measured by the indices of quantity, frequencies and duration.

When alcohol Korsakoff patients, long-term alcoholics, aphasics and normal control subjects were compared in problem solving strategies of cognition, the performance of long term alcoholics fell between those of Korsakoff patients and the two control groups (Ryan and Butters 1983, Parsons and Farr 1981, Persons and Leber 1981 quoted in Parsons et al 1987). These studies attest to the gradual development of cognitive problems associated with alcohol consumption. There was evidence of a continuum of neurocognitive deficits ranging from severe deficits in the Korsakoff patients to moderate deficits in alcoholics and moderate to mild effects in heavy social drinkers.

1.9 Organisation of the report

In the subsequent chapters, chapter two makes an attempt at giving an overview of the relationship between moderate alcohol consumption/social drinking in relation to cognitive functioning as has been revealed by previous research findings, in contrast to the proven consequences of excessive alcohol consumption. Ensuing from this, chapter three outlines the methods and procedures and testing instruments used in the present study in an effort to determine the relationship between moderate alcohol consumption and cognitive functioning.

Chapter four presents the results that the current study obtained. Chapters five and six discuss the findings of the current study in relation to the research findings obtained by previous studies. Furthermore, attempts are made at deliberating on the implications of the findings from the

current study on neuropsychological testing in relation to clinical practice. Additionally, suggestions are made on possible endeavours worth pursuing in this area of study.

CHAPTER TWO

LITERATURE REVIEW

Presented in this chapter is a review of commonly employed measures of neurocognitive functioning in relation to alcohol consumption and studies that have previously been carried out in an attempt to investigate the effect of moderate alcohol consumption on cognitive functioning. The studies cited here were sourced from various neuropsychological online Journals and books on alcohol and cognition. The key terms employed in searching for the literature were cognitive functioning, neuropsychology, and moderate alcohol consumption.

2.1 Measuring neurocognitive functioning in relation to alcohol consumption

Knight and Longmore (1994) state that measures of intelligence such as the Wechsler Adult Intelligence Scale (WAIS-R) are used with both social drinkers and alcoholics to measure their mental functioning. Memory or the ability to acquire new information is another key aspect that is measured because the ability to acquire new information is particularly susceptible to any form of brain damage. The Digit symbol is one measure that is widely used to test memory in neuropsychological practice. Other common measures are the Wisconsin Card Sorting Test (WCST), which basically measures perseverative responses. It is meant to measure mental flexibility and associated with abstraction ability. Reduced mental flexibility and excessive concreteness of thinking have been linked with frontal lobe injury although failure on tests of conceptual functioning is not confined to patients who have frontal lobe lesions. However, because frontal cortical atrophy is a frequent result of alcohol abuse, tests of conceptual functioning are often employed in neuropsychological studies of alcohol use (ibid p67-8).

Assessment of drinking practices is carried out for two basic reasons, as a means of diagnosis meant to establish whether an individual is a social drinker or a dependent drinker, and to ascertain the behaviour of individual drinkers so that these can be used as independent variables in research studies and for documentation purposes. Consumption related variables are obtained pertaining to average daily, weekly and monthly frequency of consumption as well as the usual amount consumed (Knight and Longmore, 1994). Some common measures used in assessing

alcohol consumption are the American Drinking Practices form, which measures the quantity-frequency variability index and the Annual Absolute Alcohol Index (AAAI) based on responses to 12 items that seek information on usual frequency of drinking, usual amount consumed and maximum per occasion. These measures have formed the basis for collection of data in several studies of consumption in social drinkers (Ibid).

2.2 Health consequences of long term alcohol abuse

Excessive alcohol consumption negatively affects almost every tissue and organ of the body. Typically, alcoholics depend upon alcohol as a major source of food. This tendency makes them prone to suffer from vitamin and nutritional deficiencies. 'A drastic reduction in the intake of proteins causes cirrhosis of the liver. Furthermore, prolonged consumption of alcohol can damage the endocrine glands or cause heart failure, hypertension, shrinking and inflammation of the lining in the stomach and capillary haemorrhage. It can also result in the lowering of the overall resistance to diseases' (Mangal, 2005).

The World Health Organisation (2004) also reports that there is a causal relationship between alcohol consumption and 20-30% oesophageal cancer, liver cancer and epileptic seizures. Additionally, WHO (2004), identifies the some common neurological conditions associated with alcoholism as being head injury, alcoholic Korsakoff syndrome, Wernicke's encephalopathy, and fetal alcohol syndrome, all of which have an impact on neurobehavioural outcome.

2.2.1 Cognitive and neuropsychological consequences of long term alcohol abuse

As a group, chronic alcoholics have a normal IQ. However, on tests designed to detect presence of brain damage, poor performance is observed in tests that measure psychomotor speed, problem-solving abilities and abstract thinking. It has further been observed that numerous studies demonstrate that detoxified long-term alcoholics are impaired on problem-solving tasks such as the WCST and the Halstead-Reitan Category Test (Parsons, Butters and Grahom, 1987). The cortical dysfunctions of alcoholic Korsakoff patients may develop slowly during many years of alcohol abuse and do not appear suddenly with the onset of Wernicke's encephalopathy. The

severity of visual-perceptual and problem-solving deficits evidenced in detoxified alcoholics may be more a function of how much, how often and how long the individual has abused alcohol as it is as a result of an acute thiamine deficiency (ibid).

2.2.2 Morphological changes in long term alcoholics

Korsakoff patients tend to have widespread cortical atrophy in addition to diencephalic abnormalities. They also exhibit a wider third ventricle, diencephalic lesions as a result of thiamine deficiency, and cortical damage secondary to the neurotoxicity of alcohol (Knight and Longmore, 1994).

2.3 Cognitive and neuropsychological consequences of moderate alcohol consumption

While the adverse effects of excessive alcohol intake on cognitive functioning have been recognised and replicated across different cultures indicating deficits in cognitive efficiency, problem solving, verbal and non-verbal abstraction, visual spatial ability, learning and memory (Kaplan and Saccuzzo (2001), Yonker, Nilsson Antenelli, Herlitz, and Agenta (2005)) the cognitive and neuropsychological effects of moderate alcohol consumption remain uncertain. Indeed for moderate alcohol consumption, studies have reported a mixture of negative, positive and in some cases non-significant outcomes with variations manifesting across gender, brain morphology and age as will be outlined in the ensuing paragraphs.

2.3.1 Manifestations of cognitive outcomes based on gender in moderate alcohol consumers

In their 1983 study, Parker, Parker, Brody and Schoenberg outlined what they termed “the carry over model of alcohol effects in social drinkers”. They selected a sample of 481 men and 544 women in metropolitan Detroit, United States of America, and obtained from the Shipley Institute of Living Scale scores and information about their drinking practices using the Cahalan et.al Questionnaire. The average Quantity Per Occasion (QPO) for men was 46.1ml and women 35.9ml. The data was subjected to multiple regression analysis and it was found that for males, there was a significant relationship between QPO and abstraction score. However, in a subgroup

of 213 women who reported drinking alcohol once a week or more (with an average of 50.3ml), regression analysis results identified QPO as an independent predictor of Shipley Institute of Living Scale scores. The magnitude of this association was not affected by any of the adjustments made for the subject's body weights. Parker, Parker, Brady, and Schoenberg (1983) concluded that there was a significant linear relationship between alcohol consumption reiterated by their carryover model as an explanation for these results. The results obtained in this study thus seemed to show that for the male gender, QPO was much more related to cognitive functioning than in the female gender. A possible explanation for this would be the relatively lower alcohol consumption consumed by the female gender recruited in this sample.

Knight and Longmore (1994, p214) cited a study carried out by Hannon et.al (1983).The study comprised 40 male and 52 female college students. The results obtained were supportive of the findings reported by Parker, Parker, Brody and Schoenberg (1983) study cited in the preceding paragraph. They administered the Shipley Institute of Living Scale, Wisconsin Card Sorting test, the Digit Symbol subtest of the WAIS, Trail Making Test (TMT), and the Tactual Performance test from the Halstead-Raitan Battery. The scores obtained from the tests were correlated with self-reported lifetime consumption, current frequency and the average QPO estimates for males and females. Higher current frequency was predictive of better performance on the abstraction scale of the Shipley Institute of Living Scale for men. Of the significant partial correlations, for women QPO predicted abstraction scores and conceptual Quotients, Lifetime consumption Predicted WCST scores and current frequency predicted reduced TMT scores. The results obtained seemed to support those of Parkers et al (1983) however, there was some inconsistency particularly between the male and female subjects.

Krahn, Freese, Hauser, Barry and Goodman (2003) carried out a study on the nature of the relationship between moderate alcohol use and cognitive functioning in abstract reasoning tests such as the Wechsler Adult Intelligence Scale. Their study controlled for educational attainment. They hypothesized that this variable could be associated with both alcohol intake and later cognitive functioning. When educational attainment was not controlled for, it was found that both men and women with an alcohol consumption of 0-1 drink a day showed better scores on the abstract reasoning subtest of the Wechsler Adult Intelligence Scale (WAIS-R) when

compared with the non-drinking participants. However, when educational attainment was controlled for, it was discovered that men with lower levels of alcohol consumption no longer had higher abstract reasoning when compared with the non-drinking men. In the female participants however, when adjustments were made for educational attainment, results showed that moderate alcohol consumers had the highest scores on cognition. These results thus showed that moderate alcohol consumption was more favourable for women in terms of cognitive functioning.

Furthermore, in the Whitehall II study by Britton, Manoux and Marmot (2004), involving a large sample of 4,272 men and 1,762 women who reported consuming at least a glass of alcohol a day in the past week for the previous year, the moderate drinkers when compared with non-drinkers were found to be less likely to have poor cognitive function. However, this effect was found to be stronger for women than men. They reported that similar associations were found in both cross-sectional and longitudinal analysis. It should be noted, that the Whitehall II study had strengths of having had a follow up in a longitudinal study of 11 years. The study also carried out repeated measures of alcohol consumption over the years.

Yoker, Nilsson, Agneta, Herlitz and Anthenelli (2005), carried out a study in which they recruited a sample of 2,224 randomly selected adults aged between 35 and 85 years. Participants were classified into non-drinkers, light drinkers, moderate drinkers and heavy drinkers. The researchers took in to consideration that established knowledge shows that certain cognitive components show that clear gender differences exist in areas of episodic memory task which have been found to be more advantageous for women, and spatial to visualization tasks that seems to favour men more. These cognitive tasks were employed in the study to assess performance by gender and drinking patterns.

Results showed that moderate alcohol intake appears to be more beneficial in women and not necessarily in men as the visual spatial performance in men appeared weaker in the drinking group than the non-drinking male group, whereas performance by women in episodic memory tasks was rather consistent across all levels of alcohol consumption.

The study was however, not without its limitations, for instance, the validity of self-reported measures of alcohol could be questioned, also ‘the non-drinkers in this study were identified to have been older, of lower education, took more prescription medication and generally felt less healthy than moderate drinkers’ (ibid). All these factors could have negatively impacted on their performance on the cognitive tasks.

A study by Richards, Hardy and Wadsworth (2005), investigated the relationship between self-reported alcohol consumption and cognition (memory, speed of information processing and concentration) between 43 and 53 years in the British cohort study. The researchers controlled for general ability, in terms of the participants physical and mental functioning and socio-economic status. This was done to rule out the possibility that those of higher cognitive ability actually engaged in a lifestyle that protects them against cognitive decline.

Results obtained showed that moderate alcohol consumption in men was associated with a slower decline in memory, while psychomotor decline was associated with moderate alcohol consumption in women. Additionally, the protective effects on memory decline in men seemed apparent at all levels of alcohol consumption with no differences between light and heavy social drinkers, whereas in women there was evidence of a more rapid decline in psychomotor speed with increasing alcohol consumption’(ibid).

2.3.2 Brain atrophy

While many researchers seem to suggest that there may be a significant effect of social drinking on cognitive functioning, other research findings suggest that a link also exists between low to moderate alcohol intake and decrease in brain size especially in the middle aged population.

One of the studies exploring this was conducted by Ding, Marsha, Eigenrodt, Thomas, Hutchinson, Folsoms, Harris and Nieto (2003). They observed that moderate alcohol intake may result in impaired cognition and motor functioning due to the associated brain atrophy. They used magnetic resonance imaging (MRI) to measure the brains of 1,909 male and female participants aged 55 and older. Although the researchers do not claim a causal relationship

between moderate alcohol intake and brain atrophy, they do assert that there is a relationship between moderate alcohol intake and brain atrophy. The strength of their study was in the large sample which was representative with regard to gender and race (Ding, Marsha, Eigenbrodt, Thomas, Hutchinson, Folsom, Harris and Nieto. 2003).

Parsons, Butters and Nathan (1987), carried out a correlational study of drinking pattern variables and signs of brain damage as assessed by neuropsychological tests and CT scan, of a sample from the general population. Results showed that male social drinkers, manifested mild cognitive deficits and morphological cerebral changes as a result of recent alcohol intake. After the effects of recent alcohol intake were excluded, mild cognitive deficits could still be detected in the males, but no morphological changes. The cognitive deficits were correlated with long-term excessive social drinking. In females, there was no association between the drinking variables and cognitive deficits or morphological changes possibly due to the less advanced drinking habits of females.

From the results of the study, it can be concluded that mild signs of brain damage can appear not only in alcoholic patients, but also in male social drinkers randomly taken from the general population.

To conclude, Verbaten (2009) is of the idea that past studies seem to show that even consumption of light to moderate doses of alcohol may lead to shrinkage of the brain and to increase in white matter volume and decrease in gray matter volume thus changing the brain's health parameters and hence negatively correlated to cognitive performance. This in itself, he asserts seems to support Ryback's continuum hypothesis of alcohol consumption and its effects on brain functioning. This, however, does not seem to be the case in the elderly moderate alcohol drinking group, who, as will be explained in the following paragraphs seem to be more inclined to have beneficial effects from consuming alcohol in moderation.

2.3.3 Age effects on cognitive functioning in relation to moderate alcohol consumption

It has been observed that typically, the beneficial effects of light to moderate drinking on various aspects of cognitive functioning are found in older persons in the majority of studies. The mean age of the subjects in whom improvement of cognition is detected is in the above 65 year olds. This conclusion was based on a review of all the publications on low to moderate alcohol consumption and cognition (Verbaten 2009). Some studies that have yielded results to this effect are presented below.

Stampfer, Kang, Chen, Cherry and Grostein (2005), carried out a study to evaluate cognitive functioning in relation to age in a sample of 12,480 women with an age range of 70 to 81 years. Follow-up assessments were made in 11,102, of the participants in a two year longitudinal study. Results showed that older women who took up to one drink per day had consistently better cognitive performance than the non- drinking women. With regard to types of alcoholic beverage there were no significant differences in risks with regard to beverage type. This was statistically analysed for by constructing separate regression models for alcohol ranging from beer, white, red wine and spirits and controlled for alcohol from other sources within each level of total alcohol intake. Hence beverage type was not a predictor for cognitive functioning as drinking (ibid).

McDougall, Becker and Areheart (2006) also carried out a study which showed that older men who drink in moderation differ from those who do not drink on measures of cognitive functioning, affect and health. The drinkers were reported to have significantly less depression, better health and higher cognitive performance, cognitive flexibility and verbal memory. Similar results indicating better performance in the older drinking individuals than the non-drinking elderly individuals were also reported by Lang, Wallace, Huppert, and Melzer (2007). They recruited a sample of six thousand and five individuals aged 50 and above.

‘Measures of cognitive functioning, subjective well-being, and depressive symptoms were compared with having never before consumed alcohol, having quit drinking, and drinking less

than one, less than two and more than two drinks per day. Results showed that in middle-aged and older men and women, moderate levels of alcohol consumption are associated with better cognitive health than abstinence' (Ibid 2007).

It can thus be said that there seems to be a beneficial effect of light to moderate drinking but only in the elderly. However, it remains to be established exactly in which way alcohol consumption protects against the normally occurring effects of brain aging. Verbaten (2009) however, points out that based on the studies conducted by Den Heijer et al (2004) and Wessler et al (2007), it can be suggested that light to moderate drinking stops or decreases the age dependent deterioration of white matter, this could explain the superior cognitive performance of older light and moderate drinkers compared to older abstainers (opcit).

2.3.4 Variations in outcomes of moderate alcohol consumption in relation to neurocognitive functioning

Some studies have revealed a mixture of outcomes when moderate alcohol consumers and non-drinkers are compared in terms of cognitive functioning. To illustrate this, Mac Vane et al (1982), compared groups of light–moderate and heavy drinkers on the cognitive tests. The only significant differences that emerged were on the WAIS vocabulary scale. In general, there were low but significant negative correlations between consumption and cognitive performance.

Parker (1982) commented on Mac Vane's study in Knight and Longmore (1994) noting that Mac Vane's study provided an important and independent replication of the early studies. She however made it explicit that she did not regard the findings so far reported as indicating that social drinking resulted in brain damage, but rather that it may cause subtle but reversible decrements in cognitive performance similar to those associated with aging.

Jones–Scumty and Zeiner (1985), Page and Cleveland (1987) in Knight and Longmore (1994) also highlighted studies in which they administered the Shipley Institute of Living Scale to a sample of social drinkers with an average age of 20. No significant correlations between QPO and other indices of drinking behavior, and Shipley Institute of Living Scores were found. Page

and Cleveland (1987) included a social drinking sample in their comparison study of alcoholics, abstinent alcoholics, and non-drinkers. Although there was evidence on the neuropsychological tests of impairments in the alcoholic group, no differences between social drinkers and non-drinkers were found.

In a similar study Emmerson, Dustman, Heilshearer (1988) quoted by Knight and Longmore found no significant differences between non-drinkers and social drinkers, and no correlation between consumption variables and any of the neuropsychological tests they employed.

The inconsistencies of the effects of social drinking have continued to manifest even in more recent studies, for instance, Clinton, Wright, Mitchell, Elkind, Xiandong, Myunghee, Paik and Ralph (2006) carried out the Northern Manhattan study (NOMAS) that yielded a positive relationship between reported moderate alcohol intake and cognition. They found that moderate alcohol intake decreased the risk of cognitive decline this was especially true for participants who consumed less than one drink per day. A positive relationship was seen between reported alcohol intake and cognition. Drinking less than one drink a week ($P=.09$), between one drink weekly up to two drinks daily ($P=.001$), and more than two drinks daily ($P=.003$) were associated with less cognitive decline on the Telephone Interview for Cognitive Status (TICS-m) compared to never drinkers. Results also showed that there was no apparent difference in cognitive decline between past drinkers and non-drinkers.

The Northern Manhattan study (NOMAS) has the strength of having incorporated younger subjects with the mean age of ≥ 40 unlike previous studies that characteristically had been limited to older subjects. Furthermore, the study recruited a more multiethnic sample with 'approximately 63% Hispanic, 21% black, 15% white and 2% other groups (Ibid). However, the results of the study were compromised because it had a short mean follow-up of longitudinal study of 2.2 years. Furthermore, the study relied on self-reported alcohol use of current drinkers and non drinkers which made inaccurate reporting possible. Additionally the test of cognition used in the study, the modified Telephone interview for cognitive status modified version (TICS-m) is said not to be as valid as in-person testing (Clinton et al 2006).

Kalmijn, Boxtel, Verschuren, Jolles and Luaner (2002), carried out a study to determine the interaction between cigarette smoking and moderate alcohol consumption. The study comprised a sample of 12,668 Dutch adults aged 20-60 years living in Doetinchem. Cognition was measured by tests such as visual and verbal learning tests, Stroop Colour word test consisting of three subtests, Digit symbol substitution and word fluency test. The study results showed that although moderate alcohol consumption is related to increased cognitive ability and flexibility especially among women, current smoking is inversely related to psychomotor speed and cognitive flexibility. Results showed that current smoking was associated with worse cognitive performance especially in relation to the Digit symbol substitution test. This study indicates that moderate alcohol consumption in individuals who smoke cigarettes is negatively related to cognitive functioning.

It has however been observed that there appears to be no evidence that, when abstainers and social drinkers are compared significant deficits are seen: all the evidence available comes from the association within groups of social drinkers between QPO and cognitive performance. It is in this vein that the current study seeks to establish whether or not similar findings will be obtained in a Zambian scenario.

2.4 Conclusion based on literature

From the findings of the various research studies it can be proposed that alcohol consumption even in moderation seems to have an effect on the cognitive functioning although its exact mode of manifestation is yet to be established. Equally the differences observed in previous studies as outlined above, with regard to gender and age aspects are areas worth looking into in an effort to understand the pattern of such effects among the Zambian population especially in relation to neuropsychological test performance, results and interpretation.

CHAPTER THREE

METHODOLOGY

This chapter gives an account of the study design, the characteristics of the sample, recruitment criteria, and the instruments or measures employed in obtaining the data used in the present study.

3.1 Study design

This was a cross-sectional quantitative study. The aim of the study was to establish the relationship between moderate alcohol consumption and cognitive functioning.

3.2 Participants

The study comprised 324 HIV negative participants. The distribution was as follows, 157 (48.5%) were male and 167 (51.5%) were female. A total of 152 (46.9%) were from a rural setting and 172 (53.1%) were from an urban setting. Their education level ranged from 5 to 19 years of education. Mean years of education was 11.02 with a standard deviation of 2.6. All the participants were conversant with the English language. Their age range was between 20 and 65 years, with a mean age of 38.48 years with a standard deviation of 12.8.

The sample comprised 237 (73.1%) non-drinkers and 87 (26.9%) moderate alcohol consumers. Gender distribution amongst the drinkers was 55 (63.2%) males and 32 (36.8%) females.

Figure1 pie chart showing the gender distribution of the sample

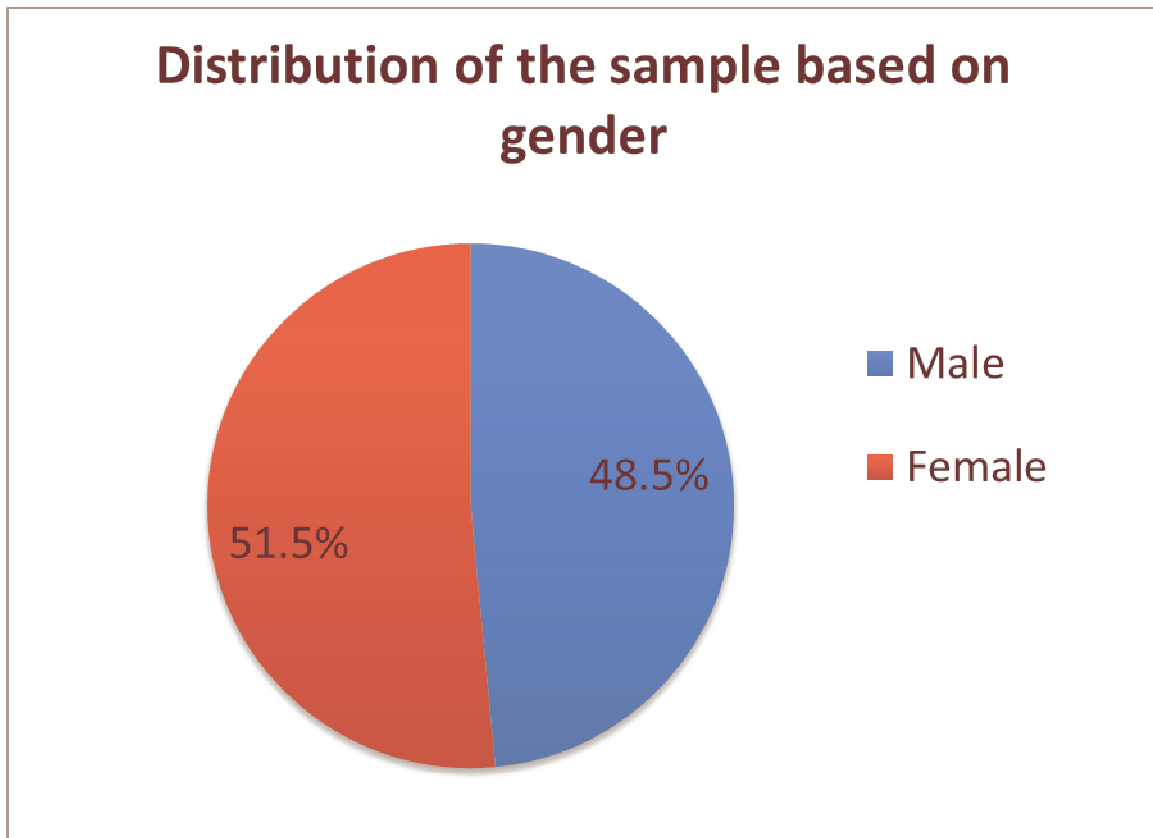


Figure 2, Pie chart showing the urban/rural distribution of the sample

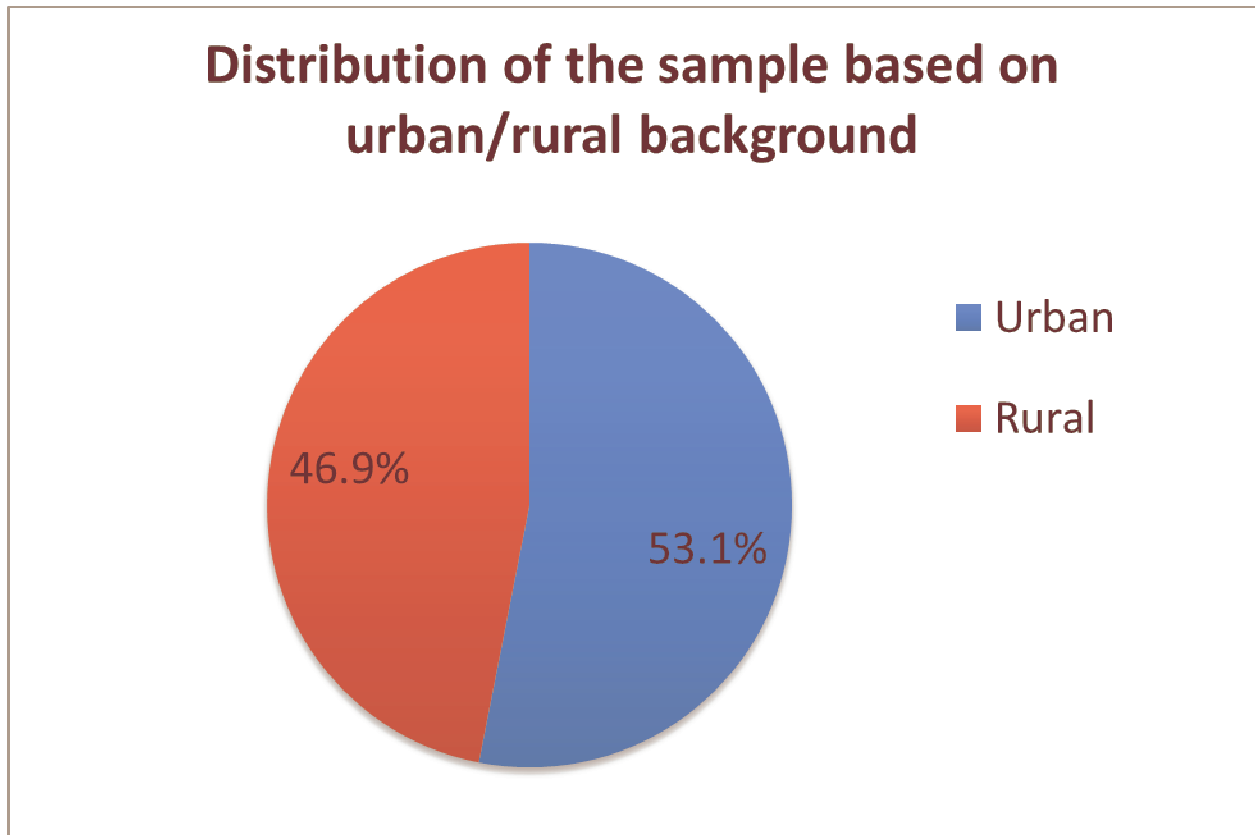


Figure 3, Bar chart showing the distribution level of education of the sample

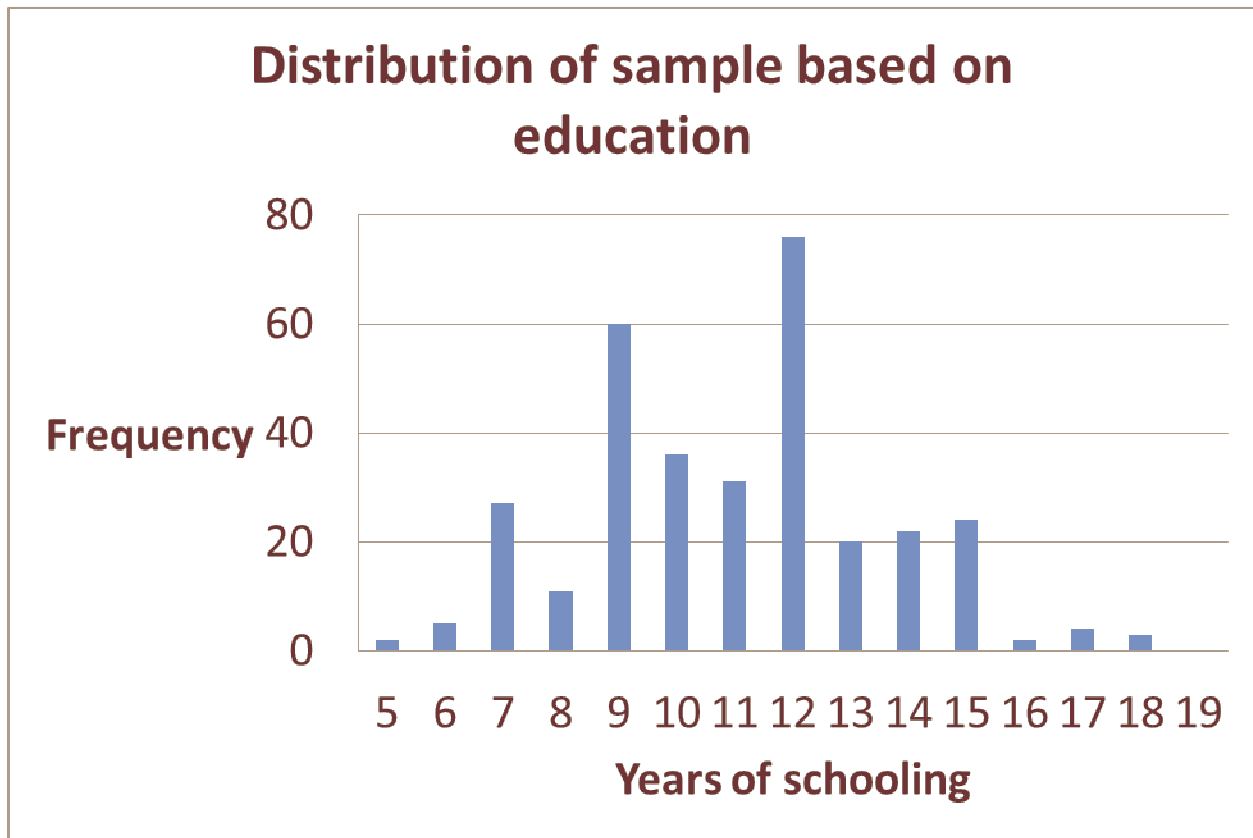
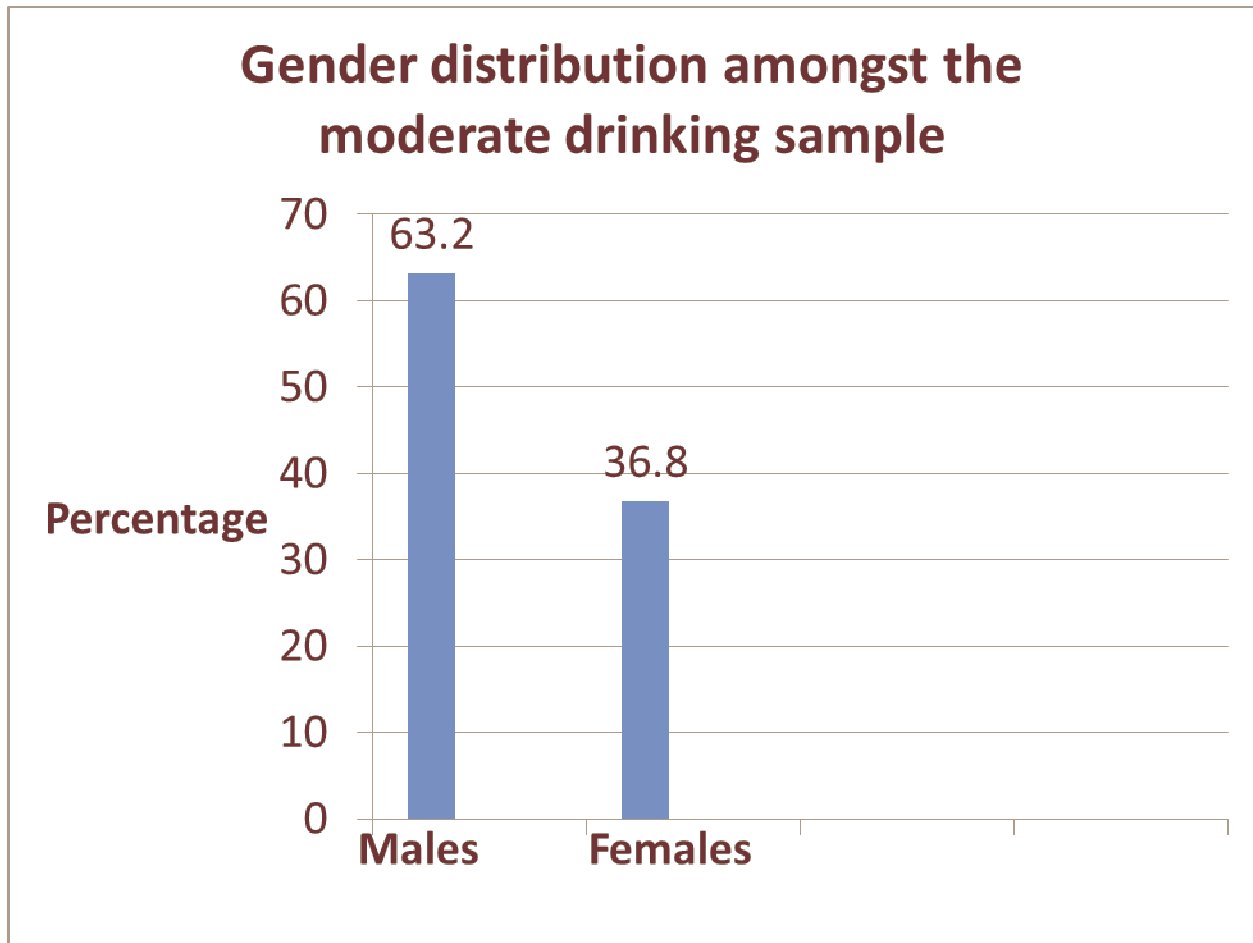


Figure 4, Bar chart showing gender distribution in the moderate drinking group of the sample



3.3 Recruitment

The sample was drawn from the rural and urban areas of Zambia. Recruitment of participants from the urban population was done from the clinics under Ministry of Health at The University of Zambia, Kalingalinga, Chelston, Mutendere, and Chilenje. The rural clinics included were Chongwe, Chibombo and Kafue Clinic. The clinics were chosen as the recruitment area because they were better placed for capturing confirmed HIV negative individuals without causing undue apprehension as the clinics were carrying out routine HIV Voluntary Counseling and Testing (VCT) services. The recruitment was done by the clinic staff, they identified HIV negative individuals through the VCT services and informed the prospective participants about the present study and sought their consent to give their contact details to the research team for possible enrollment in the study. Prospective participants were contacted by telephone and the procedure that ensued is as explained below.

3.4 Procedure

The participants were recruited through the clinic. The researcher explained the study to the participants and gave all necessary information related to the study such as, they could request for a break at any time during the testing session if they felt fatigued. Participants were also informed they could withdraw from the study at any point if they so wished. Before any data was collected, written informed consent was obtained from the participants (Appendix E).

Nine trained graduate students tested the 324 participants in single testing sessions that took an average of 2 hours 30 minutes to complete for each participant.

During the structured interview, prior to the Neuropsychology test administration, participants were administered questionnaires with sections on demographic characteristics, educational, medical and psychiatric information. They were also asked about their drinking practices in terms of frequency of consumption as well as the typical amounts consumed per drinking occasion. This information was obtained by administering orally questions from the structured Chinese Substance Use History questionnaire (See appendix A).

After being administered the various questionnaires mentioned above which also served as a means of screening the participants, those who qualified to be part of the study sample were then administered the Zambia Neurobehavioural Test Battery (See appendix B).

Administration of the Zambia Neurobehavioural Test Battery was carried out in the same order, with the aid of standardized instructions using the Neurobehavioural Testing Booklet.

Participants were compensated by payment of transport and refreshment allowance at the end of the testing session.

3.5 Inclusion and exclusion criteria:

Inclusion:

❖ HIV negative

-HIV negative confirmation by means of a rapid HIV-1 antibody test to be carried out study site clinic staff.

❖ Educational level

- Between Grade 5-13+ > obtained by means of the Demographic Questionnaire (See appendix C).

❖ Age range of

-Between the ages of 20 and 65 years >Demographic Questionnaire.

❖ Ability to speak and understand English

- Assessment by means of the WRAT (See appendix D).

Exclusion:

❖ History of neurological problems

-For instance, Epilepsy, closed head injury, coma > Neurobehavioural Medical Screen which assess past medical and neurological histories.

❖ History of drug abuse

-Assessed by means of the Substance Use and Chinese Substance Use History questionnaire which captured the units of alcohol consumed.

-Moderate alcohol consumption for males =21 units of alcohol per week and 4 units per day. While moderate alcohol consumption in females is measured as being =14 units of alcohol per week and 3 units per day (WHO, 2004).

- The substance use history form was used to exclude individuals abusing either prescriptive or 'recreational drugs'.

History of Psychiatric illness [Use of the Composite International Diagnostic International Interview (CIDI)] - It is a structured questionnaire using the DSM –IV and ICD-9 diagnosis it captures Depression, Dysthymia and substance related disorders. Depressive symptoms were assessed by means of Beck Depressive Inventory.

3.6 Measures

The assessment used in this study was as follows:

3.6.1 Measures in the test battery capturing cognitive functioning

Various aspects of cognitive functioning in the present study were evaluated by means of The Zambia Neurobehavioural Test Battery measuring cognition in the areas of *Verbal Fluency, Working Memory, Speed of Information Processing, Learning and Delayed Recall, Executive Functioning, and Motor Speed and Dexterity* (see appendix B). These components of cognitive functioning are elaborated on as follows;

❖ *Executive functioning*

Executive Functioning according to Strauss, Sherman and Spreen (2006; p401), quoting Lezak et al (2004) is an 'intrinsic ability to respond in an adaptive manner to novel situations. It can also be conceptualized as having four components: Volition, Planning, Purposive action and effective performance. Baron (2004) quoted by Strauss, Sherman and Spreen (2006) defines Executive Functioning as 'The metacognitive capability that allows an individual to perceive stimuli from his or her environment, respond adaptively, flexibly change direction, anticipate future goals, consider consequences and respond in an integrated or common sense way, utilizing all these capacities to serve a common purpose goal. Executive Functioning can also be said to be the ability to put together information, to formulate hypotheses about a situation in problem solving, planning, decision making, self- awareness, insight, error correction or trouble shooting,

responding to novel situations, interference control, regulation of impulses, inhibitions as well as flexibility (www.northeastcenter.com/).

Executive functioning in the present study was captured by means of;

- *Wisconsin Card Sorting Test* – computer version 2 (Research Edition:64 items), this test requires the test taker to match a card depicting a geometrical form that appears at the bottom of the computer screen with one of the four stimulus cards at the top of the computer screen. The four cards at the top of the computer screen bear four different geometrical forms, the first one has a red triangle, the second, two green stars, the third has three yellow crosses and the fourth has four blue circles. The cards that appear at the bottom of the computer screen one at a time vary in colour, geometric form and number. The test demands planning, use of feedback and shifting of cognitive sets. The test has no time limit.

According to Paolo, Troster and Koller (1995), the WCST has construct validity in that it shows an increase in preservative errors among individuals with frontal lobe dysfunction. This was established in their study that compared normals and individuals with Parkinson's disease.

Reliability of the test showed low retest reliability with an average of 0.43 on Pearson's r which shows that almost 80% of the results could be attributed to error variance. Bowden et al (1998) however argues that although its reliability is low and it may not be very good with specificity, it however reports high sensitivity to frontal lobe lesions.

- *Colour Trails Test 2*- This test is presented on a sheet of paper with two sets of numbers. One set of numbers is embedded in pink circles and the other in yellow circles. The task of the test taker is to join the numbered circles in sequence while alternating between the two colours. This test thus demands shifting cognitive sets. Strauss, Sherman and Spreen (2006) report its reliability at 0.64 and a validity of 0.50

- *Stroop colour and word Test*- This test involves a stimulus sheet that has words printed red, green and blue ink. The words are colour words that are incongruent to the ink in which they are

printed. The task of the test taker is to say out the colour of the ink and not the colour word printed. This test also requires shifting cognitive sets.

Test retest reliability was 0.74 to 0.88 on the reading card (word), 0.74 to 0.90 for the colours and 0.67 to 0.91 on the word colour interference. According to Lemay, Bedard and Rouleau, the stroop is said to have ecological validity based on findings reported by Van der Elsr, Van Breukelen and Jolles (2008) in which they measured the correlation with the Neurological test performance and scores on the physical functioning scale of medical outcomes study item form 36 items from the health survey.

- *Halstead Category Test*- This test involves a presentation of 208 stimuli on a computer screen. The different stimuli presented can be associated with the numbers one, two, three or four. The test taker indicates what number they believe the stimuli is indicating to them by pressing the corresponding number on the key board. The test has seven subsets. The first six has a single principle that runs through out that subset and the seventh is a revision of the first six subsets. The test taker is given feedback on their performance on the test. This test measures complex reasoning and conceptual skills.

A study by Dikmen, Heaton, Grant and Timken (1999) found that the HCT has a reliability coefficient of between Pearson's r of 0.40 to 0.85. The category test has also been cited to have a better sensitivity to brain damage than the WCST. It is said that the category Test should be a preferred measure if the clinician would like to measure a more difficult and sensitive measure of abstraction ability (Strauss, Sherman and Spreen 2006).

❖ *Working memory*

Working Memory according to Piechatzek et al (2009), quoting Baddeley (2003) and Miyake et al (2000), refers to the ability to hold information in an activated state for a short period of time ('Short-term Memory'), in order to make it available for further processing, manipulation and updating by higher cognitive processing. It has limited capacity, and its active contents decline rapidly. Working Memory and executive processes are closely related, as working memory

capabilities can be considered fundamental to many executive functions which afford the manipulation and updating of information into a longer lasting Short-term Memory.

Working Memory was captured in the following tests

- *Paced Auditory Serial Addition Test (PASAT)*-This test requires the test taker to serially add numbers presented on a computer recording. This involves adding the current number to the one that precedes it and saying the sum out loud.

Strauss, Sherman and Spreen (2006) report the reliability of the PASAT at Cronbach's alpha =0.90 and the validity of the computerized and audiotape versions appear comparable at $r=0.85$ and $r=0.95$ and is said to be sensitive to mild concussion and sensitive as an indicator of information processing.

- *Wechsler Memory Scale (WMS) – III spatial span*- This test comprises 10 cubes with the figures 1 to 10 printed on them on the side that faces the examiner. Test administration is such that the test taker is required in the first trial to tap the cubes in the same sequence that the examiner does and in the second trial the test taker is required to tap the cubes in the reverse order of the examiner.

❖ *Speed of Information Processing*

Speed of Information Processing is the ability to manage and absorb information that one is presented with, within a reasonable amount of time. It is linked to attention and concentration. It helps us to select what information will be processed (www.health.vic.gov/vprs/).

Speed of Information Processing was measured using the following test;

- Wechsler Adult Intelligence Scale (WAIS) III Digit Symbol*- The test is comprised of a sheet of paper with numbers that have to be matched with some symbols. The test taker matches the symbols and numbers as quickly as they can. This test measures psychomotor speed, concentration and also graphomotor abilities.

-*Wechsler Adult Intelligence Scale (WAIS) III Symbol Search*-This test requires the test taker to scan five shapes on the left side and determine if any of them matches any of the two shapes to the right. This test demands psychomotor speed, concentration and attention.

The WAIS Digit Symbol and Symbol Search are both reported to have psychometric integrity and portability across cultural boundaries, Gorsuch, Sakiofske and Hildebrand (2000). As the tests have proven to have not only confirmed reliability and validity across cultures it is also said to measure decline in old age. Paul and Kreiner (2000) also confirm the reliability of the test across cultures.

-*Trail Making Test A*- The task in this test is to connect as quickly as possible the randomly arranged numbered circles from 1 to 25. This test captures psychomotor speed attention and cognitive sequencing.

- *Colour Trails Test (CTT) Trails I*- The test consists of a sets of colour numbered circles. Each circle has either a pink or yellow background. The task of the test taker is to connect the numbers in order while alternating between the two colours. This test is similar to the Trails Making Test A. Colour Trails has a reliability of 0.64 and a validity of 0.41 (Strauss, Sherman and Spreen 2006).

- *Stroop Colour and Word Test*- This test consists of a word page with 100 colour words, that is, red green and blue printed in black. The task of the test taker is to read the list as quickly as they can. The other part of this test has 100 Xs printed in red, green and blue ink. The task of the test taker is to say out the colour of the ink as quickly as they can. This test measures one's ability to maintain a goal in mind and ability to inhibit habitual responses.

Stroop Colour and Word is said to have a test re-test reliability of 0.67 to 0.91. It is also said to have ecological validity (Van der Elsr, Van Boxtel, Van Breukenden and Jolles 2008).

❖ *Verbal Fluency*

Verbal Fluency is associated with the speed and flexibility of verbal thought processes (www.brainsource.com/nptestests.htm).

Verbal Fluency was measured by means of;

- *The Controlled Oral Word Association (FAS) /Word sound fluency*

This test requires the test taker to generate as quickly as possible words beginning with the letters 'F', 'A' and 'S'. The test taker has 60 seconds to produce the words none of which must be proper nouns. Different forms of the same word are considered incorrect. Perseverations and intrusions are noted.

The is reported to have internal reliability coefficient alpha of computed for total words generated per letter at $r = 0.85$ validity comparing with other phonetic fluency tasks in the high range of 0.85 to 0.94.

- *Category Fluency (Animals, Actions)*

This test has two parts; the first part requires the test taker to name as many animal names as they can in 60 seconds. The animal names can begin with any letter.

The second part requires the test taker to generate as many action word or verbs as they can in 60 seconds.

Perseverations and intrusions are noted for both parts of the test.

❖ *Learning and Delayed Recall*

Learning and Delayed Recall is the ability to acquire information or knowledge about the world. It also entails an ability to retain and retrieve such information when required to do so. It includes the dynamic process of encoding and categorizing information, storage and retrieval (www.northeastcenter.com).

Learning and Delayed Recall were captured using the following tests;

- *Brief visual-spatial Test – Revised-* In this test the test taker is presented with a card containing six simple designs in a 2 X 3 matrix. The card is presented for 10 seconds. The test taker is then

requested to reproduce the designs as accurately as they can from memory. This pattern is carried out over three trials one of which is presented after a 25 minutes delay. The test also has a recognition trial which involves the test taker being presented with a display of twelve figures to which they are required to recognize which the six original figures that were presented to them. The final trial is the copy trial, this involves the test taker to copy the six designs presented before them. The copy trail is essentially meant to rule out poor performance due to graphomotor or visuospatial impairment.

Brief Visuospatial Memory Test, Measures the test taker's immediate recall, learning rate, delayed recall and recognition for visual spatial information.

Cherner et al (2009) reports that the standardization of the BVMT-R was done in 588 healthy English- speaking adults with the range of 18–79 (M=38.6, SD=18). Education was M= 13.4, years SD= 1.8

Hierarchical polynomial regression analysis used to determine the effects of age, gender and education on test performance showed that education and gender did not influence test performance thus it was only corrected for age (Strauss, Sherman and Spreen 2006).

-Hopkins verbal Test, Revised – II-

This is a test with a list 12 of words that three semantic categories. There are four words from each of the three semantic categories. The words are read out to the test taker at the rate of one word every two seconds. The test has three trials. After each trial the test taker says out as many words as they can in any order. After 20 minutes the test taker is asked to recall the items on the list from memory. The final trial involves the test administrator reading out a list of 24 words from which the test taker is required to recall the words that appeared in the original list of words.

The Hopkins Verbal Learning Test measures one's ability to learn, and immediately recall the verbal information presented to them. It also demonstrates the test taker's ability to retain, reproduce and recognize this information after a delay.

The original English HVLT-R normative sample consisted of 1,179 adults (75% women) with age range of between 15 and 92 years. (M= 59, SD= 18.6) and education between 2 and 20 years (M=13.4, SD= 2.9). In a stepwise multiple regression index age had the largest effect accounting for 19% of the variance with no significant contribution of education or gender. Reliability and construct validity of the standard learning and recall measures on the HVLT-R include evidence of convergent, construct and discriminant validity (Strauss, Sherman and Spreen 2006).

❖ *Motor Speed and Dexterity*

Motor Speed and Dexterity is the ability to perform gross and fine motor tasks, and the ability to perform purposeful tasks associated with psychomotor speed it also involves the style and strategies one employs when carrying out motor functions. It is also associated with how effectively one is able to coordinate especially hand-eye movements as well as balance (www.northeastcenter.com and www.brinsource.com).

Motor speed and Dexterity were measured by means of;

- *The Grooved pegboard (Dominant and Non-dominant hand test)*

This test measures fine motor and speed. It consists of a pegboard with holes and 25 identical pegs which are fitted into the holes on the pegboard.

The dominant hand is tested first and then the process is repeated using the non-dominant hand.

3.6.2 Measuring alcohol consumption

To measure alcohol consumption patterns the study used the structured lay-administered drug assessment questionnaire called The Composite International Diagnostic Interview (CIDI) also known as the Chinese Substance Use History. It meets the DSM-IV and ICD-9 criteria of diagnosis. It captures the key components relevant for this study such as units of alcohol consumed in a day, week and month. The age at which the participant started consuming alcohol and how often they drink (See Appendix A). This measure was used because one of the most common methods of quantifying consumption is to compute an average daily, weekly and

monthly statistic based on responses to questions about frequency of drinking and usual amount consumed (Knight and Longmore, 1994).

Based on The World Health Organisation guidelines (2004):

The study quantified moderate alcohol consumption as ranging between;

- ❖ 21 units of alcohol per week and 4 units of alcohol per day for male participants.
- ❖ 14 units of alcohol per week and 3 units of alcohol per day for female participants.

For daily consumers of alcohol, all females consuming less than and up to 3 units each day and all males consuming less than and up to 4 units were recruited.

For weekly consumers of alcohol, all female consuming less than and up to 14 units each week and males consuming less than and up to 21 units each week were recruited.

For monthly consumers of alcohol, all female participants with a total of 56 units or less each month and all male with a total of 84 units or less each month were recruited in the study.

Information about past or present drug use was obtained by use of the Substance use History Form which takes in to account both prescription drugs as well as ‘recreational drugs’.

3.6.3 Psychiatric screening and health history

Measures of psychopathology were also administered to exclude individuals with other psychological disorders. The Beck Depression Inventory (BDI), a 21 item self-report scale was used to assess depression. It takes into account assessment based on the past two weeks. Scoring to show the severity symptoms ranges from 0-13 (minimal depression) 14-19 (mild depression), 20-28 (moderate depression) and 29-63 (severe depression) – See appendix B.

Another important component measure was that of everyday functioning Assessment which looks at an individual ability to perform everyday tasks previously and currently through the Independent Activities of Daily Living scale questionnaire as well as the Frontal System Behaviour Scale which has 46 – items assessing behaviours associated with frontal system brain damage (See appendix B).

Another cardinal measure was that of medical and neurological history. It takes into account a review of past or current neurological problems experienced by the individual. This helps to identify and rule out any confounding factors (Appendix B).

3.6.4 Reading level

The reading level of the participants was assessed by means of the Zambia Achievement Test (ZAT) (Stemler, Chamvu and Chart 2008).

Table 1 Summary table of all the measures used in the present study.

1. Measuring cognition	
Executive functioning	<ul style="list-style-type: none"> • Wisconsin Card Sorting Test • Colour Trails Test 2 • Stroop Colour and Word Test • Halstead Category Test
Working memory	<ul style="list-style-type: none"> • Paced Auditory Serial Addition Test (PASAT) • Wechsler Memory Scale (WSM)-III
Speed of information processing	<ul style="list-style-type: none"> • Wechsler Adult Intelligence Scale (WAIS)- III Digit Symbol • Wechsler Adult Intelligence Scale (WAIS)-III Symbol search • Trail making Test-A • Colour Trails Test (CTT) Trails 1 • Stroop Colour and Word Test
Verbal fluency	<ul style="list-style-type: none"> • Controlled Oral Word Association (FAS)/ Word Sound Fluency • Category Fluency (Animals, Actions)
Learning and delayed recall	<ul style="list-style-type: none"> • Brief Visual-Spatial Test-Revised • Hopkins Verbal Test, Revised-II
Motor speed	<ul style="list-style-type: none"> • The Grooved Pegboard (Dominant and Non-dominant hand Test)
2. Measuring Alcohol consumption	<ul style="list-style-type: none"> • Chinese substance use form
3. Psychiatric screening and health history	<ul style="list-style-type: none"> • The Beck Depression Inventory (BDI) • Activities of Daily Living Scale • Neurobehavioural Screening form
4. Demographics and reading levels	<ul style="list-style-type: none"> • Demographic Questionnaire • Wide Range Achievement Test (WRAT)
5. Zambia Achievement Test	<ul style="list-style-type: none"> • Reading Level

3.7 Ethical consideration

At all stages of the study from data collection, data analysis and presentation of findings, ethical issues such as confidentiality were followed. Participants gave consent after reading the study conditions (See appendix E for Informed consent form), and were not coerced to participate in the study. Measures were taken to ensure that no physical or psychological harm was inflicted on the participants. They were allowed to take breaks during the testing sessions if they felt fatigue. All the data obtained from the study was handled by the researcher and coded. No names were used. The study was approved by The University of Zambia Biomedical Ethics Committee (See appendix F).

Approval to carry out the research in various clinics was also obtained from the Ministry of Health (See appendix G).

3.8 Data management

The raw data obtained from the study was converted into standardized scaled scores (SS) with a mean of 10 and standard deviation of 3. T- Scores were also generated. T-Scores have a mean of 50 and a standard deviation of 10.

Three different kinds of T-Scores were generated;

T1- corrected for Age, Education and Gender.

T2- corrected for Age, Education, Gender and rural or urban background.

T3- corrected for Age, Education, Gender, rural or urban background and reading level as assessed by ZAT.

Standardized scores allow for analyzing results in a more meaningful way. These transformations are meant to give raw scores more intuitive meaning. They do not change the characteristics of the distribution. For instance if the distribution of the scores is skewed prior to applying the transformation, it will still be skewed after the transformation has been made (Kaplan and Saccuzzo 2001).

This study focused on T3 as this would rule out the likelihood of any possible differences observed between the drinking and non- drinking individuals being due to age, education, reading level, gender, rural or urban background.

3.9 Data analysis

All analyses were conducted using the Statistical Package of Social Sciences (SPSS; Version 15.0). The statistical package was used to generate percentages and frequency distributions of the demographics and to generate the following tests;

- ❖ Independent t-test comparing the overall cognitive performance of the drinking group and the non-drinking group.
- ❖ Independent t-test comparing the cognitive performance of the drinking males and the non- drinking males
- ❖ Independent t-test comparing the cognitive performance of the drinking females and the non-drinking females.
- ❖ Two way Analysis of Variance (UNIVARITE) to compare cognitive functioning across different age groups comparing drinkers and non-drinkers within a particular age group.
- ❖ One way Analysis of Variance (ANOVA) to compare the performance of moderate drinkers and non–drinkers based on frequency of consumption.

3.10 Methodological limitations

Although efforts were made to ensure that testing conditions were comparable to all test participants, it should be noted that one of the limitations associated with this study was a lack of convenient testing environments especially in the rural areas where in some instances a quiet place could not be found and hence the participants performance could likely have been compromised.

CHAPTER FOUR

RESULTS

4.1 Response rate

The study managed to capture a total of 324 participants as was anticipated. The response rate was thus 100%.

Table 2.1 Age and education of the drinkers and non-drinkers.

DEMOGRAPHICS	MODERATE DRINKERS <i>n</i> =87 MEAN (SD)	NON-DRINKERS <i>n</i> =237 MEAN (SD)	p- Value
Age	37.60 (12.77)	38.81 (12.02)	.452
Education	11.08 (2.62)	11.02 (2.56)	.804

*p α <.05

There was no statistically significant difference between the drinkers and non- drinkers in terms of mean age and education. Thus the sample was comparable.

Table 2.2 Distribution of the whole sample (*n*=324).

DEMOGRAPHICS	FREQUENCY	PERCENTAGE (%)
Male	157	48.5
Female	167	51.5
Urban	172	53.1
Rural	152	46.9
Drinkers	87	26.9
Non-Drinkers	237	73.1

The sample had a higher percentage of female participants (51.5%) than the males (48.5%). The sample also had a higher urban representation (53.1%) than rural (46.9%). Participants who reported not consuming alcohol (73.1%) were more than those who reported taking alcohol in moderation (26.9%). Moderate alcohol consumption is considered to be 21 units per week or 4 units per day for males and 14 units per week and 3 units per day for females.

Table 2.3 Distribution of the moderate alcohol consumers (n=87)

Variable	Rural	urban
Males	36.4%	63.6%
Females	46.9%	53.1%

Table 2.4 Mean alcohol units consumed based on gender (n=324)

Variable	Males n=157 mean (SD)	Females n=167 mean (SD)	t	p-value
Alcohol units	26.35 (55.20)	10.59 (27.0)	3.23	.001*

*P α <.05

The mean amount of alcohol units consumed by males (26.35) was more than that consumed by the females (27). The differences in alcohol units consumed were statistically significant at .001.

Table 3.1 Cognitive functioning of moderate drinkers compared to non- drinkers

VARIABLES	MODERATE DRINKERS n=87 Mean (SD)	NON – DRINKERS n=237 Mean (SD)	t	P -value
#Animals Raw	13.49 (4.03)	12.71 (3.48)	-1.712	.044*
ZAT SS	10.75 (3.30)	10.05 (2.94)	-1.821	.035*

*P α <.05

Animals test is a component of the Category Fluency Test.

An independent t- test conducted to examine the difference between moderate alcohol consumers and non- alcohol consumers in all the tests only the statistically significant results are presented here. Significant differences were observed in the tests measuring Verbal Fluency Animal raw scores;

Moderate alcohol consumers performed better (M =13.49, SD=4.03), than Non-Drinkers (M=12.71, SD= 3.48), the difference significant different at t (322) = -1.712, p<.05, effect size=0.01

T-test results for ZAT SS also show that moderate alcohol consumers performed better (M=10.75, SD=3.30) than non-drinkers (M=10.05, SD=2.94) and the difference is significant at t (321) =-1.821 p <.05, effect size=0.01

Table 3.2 Cognitive functioning of male drinkers compared to male non-drinkers

VARIABLES	MODERATE DRINKERS <i>n</i> =55 Mean (SD)		NON- DRINKERS <i>n</i> =102 Mean (SD)		t	P –value
Fluency Mean T1	51.27	(7.47)	48.93	(6.71)	-1.997	.024*
Stroop C/W T2	52.61	(8.60)	49.30	(10.21)	-2.560	.011*
Stroop C/W T3	52.78	(8.42)	48.43	(10.24)	-2.662	.009*

*P α <.05

A t-test was run to compare males who consume alcohol in moderation and males who do not consume alcohol seem to show that:

Under the Fluency Mean T1 domain, males who consume alcohol in moderation performed better (M=51.27, SD=7.47) than non-drinkers (M=48.93, SD=6.71) the difference being significant at $t(155) = -1.997, p < .05$, effect size=0.03

T-test results for Stroop Colour Word T2 show that moderate alcohol consumers performed better (M=52.61, SD=8.60) than non-drinkers (M=49.30, SD=10.21), $t(151) = -2.560, p < .05$, effect size=0.04

T-test results for Stroop Colour Word T3 show that males who consume alcohol in moderation perform better (M =52.78, SD= 8.42) than non-drinking males (M= 48.43, SD=10.24) $t(150) = -2.662, p < .05$, effect size =0.05

Table 3.3 Cognitive functioning of female drinkers compared to female non-drinkers

VARIABLE	MODERATE DRINKERS <i>n</i> =32 Mean (SD)	NON-DRINKERS <i>n</i> =135 Mean (SD)	t	P- Value
Verbal Epis Mean T3	47.36 (8.24)	50.68 (9.20)	1.868	.032*

*P $\alpha < .05$

A t-test run to compare female moderate alcohol consumers and female non- alcohol consumers show that non -alcohol consumers performed better (M= 50.68, SD=9.20) than moderate alcohol consumers (M=47.36, SD=8.24) the results were significant at $t(165) =1.868, p < .05$, effect size= 0.02

A two-way analysis between group analysis of variance was conducted to explore the association between alcohol consumption on cognitive functioning across various age groups.

Table 4.1 Two-way between-groups ANOVA for executive functioning (T3)

EFFECT	F	p -Value
Main effect of Age	2.759	.042*
Main effect of Alcohol Consumption	1.130	.289
Interaction	.052	.984

*p α <.05

There was a statistically significant main effect for age, $F(3,315) = 2.759$, $p = .042$ but not alcohol. However, the effect size was small (partial eta squared = .026). Post hoc comparisons using Tukey HSD test indicated that the mean score for the 36-45 age group ($M = 51.55$, $SD = 6.24$) was higher and significantly different from that of the 55-65 age group ($M = 48.15$, $SD = 5.8$). The 20-35 age group ($M = 49.50$, $SD = 6.7$) and the 46-55 age group ($M = 50.10$, $SD = 5.5$) did not differ significantly from either of the other groups. The main effect for alcohol consumption in moderation was $F(1,315) = 1.130$, $p = .289$ did not reach statistical significance. Interaction between age and alcohol consumption was not statistically significant $F(3,315) = .052$, $p = .984$.

Table 4.2 Two-way between-groups ANOVA for verbal fluency (T3)

EFFECT	F	p-Value
Main effect of Age	3.753	.011*
Main effect of Alcohol consumption	2.230	.136
Interaction	.193	.136

*p α <.05

There was a statistically significant main effect for age, $F(3, 315) = 3.753$, $p = .011$ but not alcohol. However, the effect size was small (Partial eta squared = .035). Post hoc using Tukey HSD test indicated that the mean score for the 36-45 age group ($M = 52.02$, $SD = 6.61$) was higher and significantly different from that of the 20-35 age group ($M = 49.24$, $SD = 6.85$) and the 46-55 age group ($M = 48.75$, $SD = 6.11$). The 56-65 age group ($M = 49.76$, $SD = 6.13$) did not differ

significantly from either of the other groups. The main effect for alcohol consumption $F(1,315) = 2.230$, $p = .136$ did not reach statistical significance. Interaction between age and alcohol consumption was not statistically significant, $F(3,315) = .193$, $p = .136$.

Table 4.3 Two-way between-groups ANOVA for working memory (T3)

EFFECT	F	p-Value
Main effect of Age	1.108	.346
Main effect of Alcohol Consumption	.093	.761
Interaction	1.138	.334

Interaction between age and alcohol consumption was not statistically significant, $F(3,315) = 1.138$, $p = .334$. The main effect of both age range $F(3,315) = 1.108$, $p = .346$ and alcohol consumption $F(1,315) = .093 = .761$ did not reach statistical significance.

Table 4.4 Two-way between-groups ANOVA for visual learning (T3)

EFFECT	F	p-Value
Main effect of Age	2.994	.031*
Main effect of Alcohol consumption	.512	.475
Interaction	1.005	.391

* $p < .05$

There was a statistically significant effect for age, $F(3,315) = 2.994$, $p = .031$ but not for alcohol. However the effect size was small (partial eta squared = .028) Post hoc comparisons using Tukey HSD test indicated that the mean score for the 36-45 age range ($M = 52.38$, $SD = 9.63$) was higher and statistically different from that of the 46-55 age range ($M = 48.28$, $SD = 9.27$). The 20-35 age group ($M = 49.56$, $SD = 9.43$) and the 56-65 age group ($M = 48.94$, $SD = 8.86$) did not differ significantly from the other groups. The main effect for alcohol consumption was $F(1,315) = .512$, $p = .475$ did not reach statistical significance. Interaction between age and alcohol consumption was not statistically significant $F(3,315) = 1.005$, $p = .391$,

Table 4.5 Two-way between-groups ANOVA Verbal learning (T3)

EFFECT	f	p-Value
Main effect of Age	.311	.818
Main effect of Alcohol consumption	.148	.700
Interaction	1.246	.293

Interaction between age and alcohol consumption was not statistically significant, $F(3,315) = 1.246, p = .293$. The main effect for both the age groups $F(3,315) = .311, p = .818$ and alcohol consumption $F(1,315) = .148, p = .700$ did not reach statistical significance.

Table 4.6 Two-way between-groups ANOVA for Motor dexterity (T3)

EFFECT	F	p-Value
Main effect of Age	1.136	.334
Main effect of Alcohol consumption	.442	.507
Interaction	.664	.575

Interaction between age and alcohol consumption was not statistically significant, $F(3, 315) = .664, p = .575$. The main effect for both the age groups $F(3,315) = 1.136, p = .334$ and alcohol consumption $F(1,315) = .442, p = .507$ did not reach statistical significance.

Table 4.7 Two-way between-groups ANOVA for Speed of Information Processing (T3)

EFFECT	F	p-Value
Main effect of Age	2.182	.090
Main effect of Alcohol consumption	.557	.456
Interaction	.053	.984

Interaction between age range and alcohol consumption was not statistically significant $F(3,315) = .053, p = .984$. The main effect for both the age range $F(3,315) = 2.182, p = .090$ and alcohol consumption $F(1,315) = .557, p = .456$ did not reach statistical significance.

Table 5 One-way between-groups ANOVA, comparing frequency of consumption and cognitive functioning across all cognitive domains.

VARIABLES	NON-DRINKER <i>n</i> =236	DAILY DRINKERS <i>n</i> =45	WEEKLY DRINKERS <i>n</i> =29	MONTHLY DRINKERS <i>n</i> =13	F	p-VALUE
	<u>MEAN(SD)</u>	<u>MEAN(SD)</u>	<u>MEAN(SD)</u>	<u>MEAN(SD)</u>		
Executive mean T3	49.8(6.4)	50.6(6.2)	50.0(5.5)	51.4(6.4)	.430	.732
Fluency mean T3	49.7(6.6)	50.1(6.7)	50.6(6.0)	52.1(7.6)	.681	.564
Working MemoryT3	49.9(7.8)	51.1(7.3)	50.2(6.9)	46.3(5.1)	1.380	.249
Visual Epis meanT3	49.7(9.5)	51.9(9.5)	49.2(8.6)	50.4(10.4)	.778	.507
Verbal Epis mean T3	50.2(8.9)	49.6(9.8)	49.4(9.1)	49.9(6.9)	.177	.912
Motor mean T3	49.8(9.4)	50.0(8.4)	50.3(8.9)	52.6(6.8)	.399	.754
Sip mean T3	49.8(6.8)	50.0(7.4)	49.1(6.1)	53.2(5.1)	1.169	.321
Global mean T3	49.8(4.9)	50.5(5.3)	49.8(4.2)	51.2(4.8)	.542	.654

A one-way between groups analysis of variance was conducted to explore the association between frequency of alcohol consumption and cognitive functioning across the domains. Participants were divided into four groups according to how often they drink.

There were no statistically significant differences in the mean scores of the four groups across all the domains.

CHAPTER FIVE

DISCUSSION

This chapter will discuss the results presented in chapter four. It will begin with a presentation of an overview of the salient findings. The subsequent paragraphs will then present a more detailed account of the findings in relation to previous findings coupled with the possible implications of the findings.

In general, results obtained from this study seem to indicate that moderate alcohol consumers do not differ from the non-drinkers in terms of cognitive functioning. However, there appear to be marginal differences in the performance of male moderate alcohol consumers when they are compared to male non-drinkers. Results yielded from this study appeared to show better executive functioning in the stroop colour and word test (Stroop c/w) in the drinking males. Differences in cognitive functioning were also observed when female moderate alcohol consumers were compared to female non-drinkers. The female drinking group appears to have performed less well on the Verbal Episodic Memory test when compared with the non-drinking female group.

There thus seem to be gender differences in the way moderate alcohol consumption affects cognitive functioning. It should however be noted that although the results obtained in this study are statistically significant they are not clinically significant. This is because both groups are within the normal range of cognitive functioning.

A normal range of functioning using the T-score would be a score lying in the range of 41-59 once a score is 10 points or more below 50 an individual is considered to be impaired. And once an individual scores 10 points or more above 50 they are considered to have cognitive strength in that domain.

The findings of this study are however in general similar to those of previous studies on moderate alcohol consumption and cognitive functioning.

5.1 Differences between moderate alcohol consumers and non-consumers of alcohol

In order to determine whether there is a difference in the cognitive functioning of moderate alcohol consumers and non-alcohol consumers' independent t-test analyses were run.

Results showed that there appear to be no major differences overall, in the cognitive functioning of moderate alcohol consumers and non-drinkers. Results obtained based on an independent t-test, presented in table 3.1 show that the only statistically significant differences in the cognitive functioning of moderate alcohol drinkers and the non-drinkers were associated with the ZAT reading test scaled scores (ZAT SS) and the Category Fluency raw scores on the animals subtest. However, because the scores that yielded cognitive differences between the two groups had not been corrected for demographics such as education and rural/urban background it cannot be conclusively assumed that the differences observed are related to alcohol consumption. It can thus be said that these findings appear consistent with previous studies. Page and Cleveland (1983); Emmerson, Dustone and Heilshearer (1988), quoted by Knight and Longmore (1994) who reported no significant differences observed between non-drinkers and moderate alcohol consumers in terms of cognitive functioning.

The results obtained from the present study seem to imply that there is no apparent need to control for performance based on moderate alcohol performance. This is because there appear to be no differences overall, between the cognitive functioning on the neuropsychological tests and by extension in clinical practice of a moderate alcohol consumer and that of a non-alcohol consumer. We would thus expect them to perform at the same level.

These results are inconsistent with those obtained by Clinton et al (2006) who reported an overall positive outcome in the cognitive performance of moderate alcohol consumers when compared with the non-drinking group.

5.2 Differences with regard to gender in relation to moderate alcohol consumption and cognitive functioning.

In trying to ascertain whether there are gender differences in the way moderate alcohol consumption influences cognitive functioning as proposed in the second objective of the present study, independent t-test analyses were run comparing cognitive performance based on gender. Results obtained from this study as outlined in Table 3.2 appear to be consistent with previous studies that obtained similar results.

To illustrate this, after running t-test to compare the cognitive performance of male moderate drinkers and non-drinking males, it appears that the drinking males were performing better than the non-drinking males on the Fluency mean T1, corrected for age, education, and gender, the Stroop Colour and Word T2, which was corrected for education, gender, urban/rural as well as T3 which was corrected for age, education, gender, rural/urban and ZAT.

The differences observed on the stroop T3 showed that the drinking male ($M=52.78$) performed marginally better with less than one standard above the mean, than the non-drinking male ($M=48.43$) whose performance was less than one standard below the mean of 50 for T-scores. T-scores have a mean of 50 and a standard deviation of 10, hence because the mean score for the drinking males was not 60 or more and that of the non-drinkers was not 40 or less both groups lay within the normal range.

Parallel to these findings are previous research findings reported by McDougall et al (2006, p6) stating that males in the drinking group of their sample scored higher on cognition than those in the non-drinking group. They further stated that similar findings were reported by Leroi et al (2002) and Wang et al (2002). Similarly, Krahn, Freese, Hauser, Barry and Goodman (2003) reported that in their study, meant to evaluate the relationship between moderate alcohol consumption and cognition, results obtained seemed to portray that alcohol consumption was beneficial in terms of cognition in both based on gender when they had not controlled for education. Both genders scored better on abstraction and reasoning subjects of the WAIS-R when compared to the non-drinking of the same gender. However, when educational attainment

was controlled for, it was discovered that drinking males no longer had higher abstract reasoning when compared to non-drinking males. In the female group however, with adjustment for age, the drinking females seemed to have more beneficial results than the non-drinking group.

In this respect, their results contradict those obtained in the present study, as can be noted from Table 3.3 which shows that the drinking females ($M=47.36$) seem to have performed less well than the non-drinking females ($M=50.68$) based on performance on the verbal episodic mean T3. Similar to this study's findings Richards, Hardy, and Wadsworth (2005) report that alcohol consumption in women was associated with a rapid decline in search speed when compared to abstainers.

It should be noted also that in both cases the differences are marginal and the Cohen's effect size attributed to the influence of alcohol consumption in the differences of means was quite small. The effect size for the differences in the male group was 0.03 and in the females the effect size was 0.02. Therefore the differences are not clinically significant although the results appear to support the assumption that there are gender differences in the way alcohol consumption affects cognitive functioning.

Yonker, Nilson, Agneta, Herlitz and Anthenelli (2005) also reported contradicting results to those found by this study. They found that moderate alcohol consumption in women seemed to be beneficial for cognitive functioning. However, they also pointed out that the non-drinking group was disadvantaged as it typically comprised older individuals, of lower education who took more prescription medication than the drinkers. This it was noted could have accounted for their poor performance on the cognitive tests in their study.

On the other hand, Richards, Hardy and Wadsworth (2005) found that moderate alcohol consumption in men was associated with a slower decline in memory, while psychomotor decline was associated with moderate alcohol consumption in women. These results appear to be consistent with those found in the present study in that there was a seemingly positive effect associated with moderate alcohol consumption in males while negative effects were observed in females.

The differences in the effects of moderate alcohol consumption on men and women could be attributed to biological sex differences in alcohol metabolism involving differences pertaining to body weight, tissue saturation, stomach enzymes and proportion of fat to water in the body (Britton, Manoux, and Marmot 2004).

It can thus be said that in neuropsychological and clinical practice in Zambia, it could be assumed that there may exist a measure of statistically significant differences within gender when the drinking and non-drinking groups are compared although these differences are not likely manifest in drastic differences between the drinking and non-drinking groups because in both the male and female groups, performance is within the normal range.

5.3 Differences of moderate alcohol consumption and cognition based on age.

In trying to evaluate whether alcohol consumption has more beneficial effects for a particular age group in relation to objective three of the present study, two way analyses of variance were run. The study compared different age groups 20 to 35, 36 to 45, 46 to 55 and 56 to 65. In each age group non-drinkers were compared to the drinkers using the two- way between-groups analysis of variance to ascertain cognitive performance. Results as can be seen in Table 4.1 to 4.7 shows that alcohol consumption did not account for any differences observed in cognitive performance. All the differences observed were as a result of age differences rather than alcohol consumption.

These results are thus inconsistent with previous research findings that seemed to yield results with the effect that older persons seem to benefit more from moderate alcohol consumption (Stamper, Kang, Chen and Grostein 2005; Mc Dougall, Becker and Arheart 2000) reported that older individuals who consume alcohol in moderation reported not only better health, but also better cognitive functioning.

Verbaten (2009) in his review on previous studies on moderate alcohol consumption and cognitive functioning found that the typical trend was that older people benefited more from consuming alcohol in moderation than the younger people. It is likely that such an effect was not

observed in this study because previous studies detected this trend only in the above 65 years age-group which was not represented in the sample in this study.

A possible reason explaining why the present study did not detect any differences across the age groups could be because the study did not include the over 65 year olds who have been reported by past studies as the most likely to benefit from alcohol consumption in moderation. In this regard it can be said to be said that the results obtained by this study are consistent with those obtained by previous studies. Therefore as far as the results of the present study show, it appears that no age group below the age of 65 exhibit an advantage over the other in terms of moderate alcohol consumption.

5.4 Comparing frequency of moderate alcohol consumption and cognitive functioning.

In an effort to determine if the frequency of alcohol consumption is related to cognitive functioning as proposed in objective four of the present study, one- way between-groups analysis of variance test was carried out on non-drinkers, daily, weekly and monthly drinkers. Results obtained seem to show that there are no differences in terms of cognitive functioning across the groups in all cognitive domains. (See table 5). These results are thus consistent with those reported by Parker, Brady and Schoenberg (1982) quoted by Knight and Longmore (1994) who reported the frequency of moderate alcohol consumption was not related to cognitive functioning.

It can thus be said that in the *Zambian* population of moderate alcohol consumers, frequency of consumption appears not to have much bearing on cognitive functioning neither for enhancing it nor to worsening it. Therefore the two groups are expected to perform at more or less the same level on neuropsychological tests.

Also as was presented in the current study, suggesting that 50% of road accidents are attributed to social drinkers (WHO, 2004), in delivering medical care to such individuals, suffer the misfortune of neurocognitive injury thus be considered to have fully recuperated if they also perform at a level that befits an individual of similar demographic characteristics regardless of

whether or not they consume alcohol in moderation. It can thus be said that this study has provided a good baseline for the premorbid functioning of the moderate alcohol consumers in a Zambian population.

Another interesting finding is that recorded in table 2.4 indicating that males were seen to consume more alcohol than the females this is consistent with previous findings in this area of study (McDougall et al, 2006).

Although the results obtained from this study seem to show that there may be some cognitive benefits associated with moderate alcohol consumption especially for the male drinkers, these benefits maybe counteracted by an increase in other diseases associated with alcohol consumption such as cirrhosis of the lever, pancreatitis and alcohol psychosis. Therefore to concur with Britton, Manoux and Marmot (2004), it is not proposed to use the findings from this to encourage increased consumption of alcohol.

CHAPTER SIX

CONCLUSION

The objective of this study was to examine the relationship between moderate alcohol consumption and cognitive functioning in a population based sample.

The study design employed was cross-sectional. The participants were all HIV negative. Prior to their being administered the measures of cognitive functioning as measured by the Zambia Neurobehavioural Test Battery participants were administered demographic questionnaires with measures on work characteristics, social support and health history. Measures on alcohol consumption were obtained by means of the Chinese Substance History Form. The Zambia Neurobehavioural test battery was administered in the same order with standardized instructions.

The analysis of the results used in this study had the non-drinking participants as the reference group. The moderate alcohol consumers and the non-drinking group had similar characteristics. The raw data obtained was converted into T-Scores corrected for age, education, gender, rural/urban background and reading level according to ZAT.

Results obtained seem to imply that there are marginal differences in the cognitive performance of drinkers and non-drinkers in terms of cognitive functioning. The male drinking group performed better ($M=52.78$), than the non-drinking males ($M=48.43$), while the drinking females performed less well ($M=47.36$) than the non-drinking females ($M=50.68$).

Overall, the implications of the findings in the present study are that in providing Neuropsychological assessment in clinical practice there appears to be no apparent need to adjust or correct for alcohol consumption in moderation when dealing with such a client. This is so because all the results obtained though statistically significant seem to show that both moderate alcohol consumers and non-moderate alcohol consumers fall within the normal range of cognitive performance. Thus in the administration of the Zambia Neurobehavioural Test Battery it would be expected that individuals from either group are likely to perform at more or less the same level provided they possess similar demographic and health status characteristics.

Another important implication of the results obtained from this study is that it has provided a premorbid functioning of the moderate alcohol consumers. Therefore, when dealing with a person suffering from neurological problems as following an incidence of traumatic head injury for instance, the information gleaned from this study would prove helpful in determining the prognosis of such an individual in neuropsychological assessment and clinical practice.

6.1 Limitations and strengths of the study

Limitations associated with this study are that; the measures of alcohol consumption were self-reported thus it is possible that the participants could have given inaccurate responses with regard to how much alcohol they consume and the frequency with which they consume it. However, the use of the Chinese Substance Use form strengthened the study because it meets the DSM-IV and ICD-9 criteria of diagnosis. Although this study had controlled for other drugs it did not control for cigarette smoking which is reported to have implications on cognitive functioning (Kilmijn et al 2002).

Another limitation is with regard to confounding factors such as the possibility that moderate alcohol consumers are most likely to have favorable health characteristics which may have had an influence on their cognitive functioning. For instance, hypertension which is known to adversely affect cognitive functioning is said to be more prevalent in abstainers than those who drink alcohol in moderation (Onwubere, 2005).

One of the strengths of this study is with regard to age distribution. Previous studies have typically used older participants and thus this study was able to evaluate if there are differences in a younger sample. Another strength associated with this study was that it had corrected for educational attainment which was lacking in some previous studies.

6.2 Recommendations

Based on the findings of this study pertaining to the possible negative effects of moderate alcohol consumption especially in women it is recommended that further studies be carried out to better understand this area of possible concern.

This study also acknowledges that the relationship between moderate alcohol consumption could more effectively be established in a longitudinal study which would allow for a more systematic observation of cognitive functioning in relation to alcohol consumption overtime.

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