Towards a responsible food-based dietary guideline for alcohol consumption for South Africa

Ramokoni E. Gopane

11031077

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Supervisor: Prof. H.H Vorster
Co-supervisor: Prof. A. Kruger
Prof. B.M. Margetts

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SUMMARY

Background

Alcohol abuse in South Africa is a major problem. It has negative social and health consequences. The social effects include a contribution to high levels of crime, road accidents, intentional and unintentional violence, irresponsible sexual behaviour associated with the HIV/AIDS pandemic, as well as the high prevalence of foetal alcohol syndrome and poverty. The health consequences are many, including malnutrition, some cancers and liver cirrhosis. Reported intakes amongst South Africans are high, but it is especially the pattern of intake, binge drinking, that is of concern. The recommendation about alcohol intake in the South African food-based dietary guidelines (FBDGs), state that "if you drink alcohol, drink sensibly". Clearly, this guideline is not having the intended effects.

Objectives

The first objective of this study was to review alcohol consumption patterns, its negative effects, but also its putative beneficial effects in the South African population, with a focus on Africans. The second objective was to analyse the FBDGs from 75 different countries to assess how alcohol recommendations in other countries are made. The third objective was to examine the relationships between alcohol intake and health effects in Africans in transition, using the results from the THUSA-study. The last objective was to integrate all these findings to make a recommendation on how the South African FBDG for alcohol could be re-formulated to be more effective.

Main findings

The literature shows that the Colonial and Apartheid past of South Africa probably contributed to a pattern of drinking in African men which is reflected in the high intakes and binge drinking of the present. No evidence that the beneficial cardio-protective effect of moderate alcohol consumption, described for many European populations, could be found for Africans. The analysis of the THUSA data showed that the expected beneficial effects of alcohol consumption on HDL-cholesterol levels were seen, but that intakes were associated with a significant increase of serum ferritin levels in African men and women. Using serum ferritin as indicator of negative or positive iron balance, 23% of female drinkers compared with 11% of non-drinkers, and 46% of male drinkers compared to 25% of non-drinkers were in positive iron balance, having a risk of iron-overload. Because both drinkers and non-drinkers had high HDL-cholesterol levels (means between 1.07 and 1.30 mmol/L) it was argued that the negative health effects of alcohol consumption in this African population outweighed possible beneficial effects.

Conclusions and recommendations

It was concluded that there is little evidence that moderate alcohol consumption has beneficial or cardio-protective effects in black South Africans. It was further concluded that the negative effects on iron status as well as all the other reported social and health consequences of alcohol misuse or abuse, indicate that the South African FBDG on alcohol should be revisited. Three possibilities are discussed, namely to avoid making a recommendation, to recommend "not to drink at all" or to change the present qualitative guideline into a more explicit quantitative one, giving information that could motivate more responsible drinking. It is recommended that these options should be considered by a multi-sectorial stakeholder group to reach consensus about a possible new guideline, and that this guideline should be aggressively marketed, using social marketing principles to change alcohol consumption behaviour of South Africans. One of the limitations of this thesis is that no data were available on the awareness and knowledge of the South African population about the FBDG on alcohol. It is recommended that a study to assess this is done urgently.

OPSOMMING

Agtergrond

Alkoholmisbruik in Suid-Afrika is 'n wesentlike probleem. Dit het negatiewe sosiale en gesondheidsgevolge. Die sosiale gevolge is onder andere alkoholmisbruik se effek op misdaad, padongelukke, geweld, onverantwoordelike seksuele gedrag wat met die MIV/VIGS pandemie verbind word, sowel as die hoë voorkoms van fetale alkohol-sindroom en armoede. Daar is verskeie gesondheidsgevolge, soos wanvoeding, sommige soorte kankers en lewer-sirrose. Gerapporteerde alkoholinnames van Suid-Afrikaners is hoog, maar dit is veral die patroon van fuiwery wat kommerwekkend is. Die aanbeveling vir alkoholinname in die Suid-Afrikaanse voedsel-gebaseerde dieetriglyne (VGDRe) is: "as u drink, drink verstandig". Dit is duidelik dat hierdie riglyn nie die gewensde effek het nie.

Doelstellings

Die eerste doel van hierdie studie was om 'n oorsig te doen van alkoholverbruik in Suid-Afrika, insluitende die hoeveelhede, patrone, asook die negatiewe en beweerde voordelige effekte, met 'n fokus op die swart bevolkingsgroep. Die tweede doel was om die VGDRe van 75 verskillende lande te analiseer om te kyk hoe ander lande aanbevelings oor alkohol maak. Die derde doel was om die verwantskappe tussen alkoholverbruik en gesondheid in die swart THUSA-populasie te ondersoek. Die laaste doel was om al hierdie inligting te integreer sodat aanbevelings oor die herformulering van 'n dieetriglyn vir alkohol gedoen kon word.

Belangrikste bevindings

Die literatuuroorsig het getoon dat die voormalige Koloniale- en Apartheids-verlede van Suid-Afrika waarskynlik bygedra het tot die huidige drinkpatrone van swart mans. Geen bewyse kon gevind word dat matige alkoholverbruik beskerm teen hartvatsiektes, soos beskryf vir verskeie Europese populasies, ook in swartes van toepassing is nie. Die analise van die THUSA-data het getoon dat alhoewel die voordelige effekte van alkohol op HDL-cholesterol waargeneem is, alkoholinname geassosieer was met betekenisvolle verhoging van serum-ferritien van swart mans en vroue. Indien serumferritien as aanwyser van negatiewe en positiewe ysterbalans gebruik word, is bevind dat 23% van die vroulike drinkers teenoor 11% nie-drinkers en 46% van die manlike drinkers teenoor 25% nie-drinkers, in positiewe ysterbalans was, en dus 'n risiko vir ysteroorbelading gehad het. Omdat beide drinkers en nie-drinkers hoë HDL-cholesterolvlakke gehad het (gemiddeldes het tussen 1.07 en 1.30 mmol/L gewissel) is daar geargumenteer dat in hierdie populasie, die negatiewe gesondheids-effekte van alkohol die moontlike positiewe effekte daarvan oorskadu het.

Gevolgtrekkings en aanbevelings

Daar is tot die gevolgtrekking gekom dat daar min bewyse is dat matige alkoholverbruik voordelige effekte op die kardiovaskulêre stelsel in swartes het. Daar is ook beredeneer dat die negatiewe effekte wat alkohol op ysterstatus het, tesame met al die gerapporteerde nadelige sosiale en ander gesondheidseffekte, aandui dat die Suid-Afrikaanse dieetriglyn vir alkohol moontlik hersien behoort te word. Drie opsies vir moontlik hersiening word bespreek, naamlik om geen aanbeveling te maak nie, of om aan te beveel dat niemand moet drink nie, of om die huidige kwalitatiewe riglyn te verander na 'n meer eksplisiete kwantitatiewe riglyn om mense te motiveer tot meer verantwoordelike alkoholverbruik. Dit word aanbeveel dat 'n multi-sektoriale groep van belanghebbendes saam oor so 'n riglyn moet besluit. So 'n riglyn behoort aggressief bemark te word deur van sosiale bemarkingsbeginsels gebruik te maak om alkohol-verbruikersgedrag van Suid-Afrikaners te verander. Een van die beperking van hierdie proefskrif is dat geen inligting oor die bewusteheid en kennis van die Suid-Afrikaanse populasie oor die alcohol dieetriglyn bestaan nie. Daarom word dit aanbeveel dat 'n drigende studie hieroor gedoen word.

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LIST OF ABBREVIATIONS

AIDS	Acquired Immuno-deficiency Syndrome
CVD	Cardiovascular disease
CHD	Coronary heart disease
CAD	Coronary artery disease
DRV	Dietary Recommended Values
FAO	Food and Agricultural Organization
FAS	Foetal alcohol syndrome
FBDG	Food-Based Dietary Guideline
FBDGs	Food-Based Dietary Guidelines
g/day	Gram per day
g/dL	Grams per decilitre
g/ml	Gram per millilitre
HDL	High-density lipoprotein
HIV	Human Immuno-deficiency Virus
ICD	International Classification of Disease Codes
LDL	Low-density lipoprotein
CRP	C-reactive protein
ICAM	Intercellular adhesion molecule
IL	Interleukin
PKC	Protein kinase C
RTIs	Road traffic injuries
VCAM	Vascular cell adhesion molecule
VEGF	Vascular endothelial growth factor
MRC	Medical Research Council
PURE	Prospective Urban and Rural Epidemiology Study
SADHS	South African Demographic and Health Survey
TIBC	Total iron binding capacity
THUSA	Transition and Health during Urbanisation of South Africa
WHO	World Health Organization

CHAPTER 1:

INTRODUCTION

1.1 Background and motivation

South Africa is a developing country, experiencing a rapid epidemiological transition because of urbanisation, globalisation, exposure to the new global economy and instant communication. This process is characterised by changing dietary patterns as well as stressful circumstances during which people have to cope with new environments and new lifestyles, often forsaking traditional values and customs (Vorster *et al.*, 2005).

It can, therefore, be expected that in this process, alcohol consumption could also change. The present available data show that during urbanisation, acculturation and modernisation of the South African population, traditional home-brewed alcoholic beverages are replaced with commercial products. It is also documented that South African people who drink have very high alcohol intakes (Parry *et al.,* 2005) and that binge drinking, especially over weekends, is a problem (Parry & Bennetts, 1998; WHO, 2004).

One of the South African Food-Based Dietary Guidelines (FBDGs) about alcohol states that "*if you drink alcohol, drink sensibly*" (Van Heerden & Parry, 2001). This guideline was formulated taking the reality into account that there will always be drinkers in the South African Society, and that despite the many known adverse effect of alcohol, in moderate amounts it may even have beneficial effects. The impact of this guideline on drinking patterns in South Africa has not been evaluated.

The scale of alcohol use extends from abstinence and moderate, low-risk consumption (the most common pattern) to heavy risk use, problem drinking, harmful use and alcohol abuse, and the less common but more severe alcoholism and alcohol dependence (Saitz, 2005; Rehm *et al.*, 2003).

Published research on health benefits of regular moderate low-risk alcohol consumption include reduced myocardial infarction rates, reduced risk of ischaemic stroke, lower risk for dementia, decreased risk of diabetes, and reduced risk of osteoporosis (Agarwal, 2002; Agarwal & Srivastava, 2001; Corrao *et al.*, 2000; Gaziano *et al.,* 2000; Gronbaek *et al.,* 1999;

McKee & Britton, 1998; O'Keefe *et al.*, 2007; Rimm *et al.*, 1999). Several biochemical changes have been identified that explain the beneficial effects of moderate alcohol consumption on the development of coronary heart disease and atherosclerosis (Srivastava *et al.*, 1994; McKee & Britton, 1998; Opie & Lecour, 2007). These factors include effects of alcohol on circulating high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), plasma apolipoprotein (a) [Lp(a)] levels, platelet aggregability, blood fibrinolytic activity, insulin sensitivity, oestrogen levels and stress experience (Agarwal, 2002; O'Keefe, 2007).

Investigations show that even the slightest immoderate drinking presents a harmful risk. This illustrates the wisdom Mark Twain advocated. "Everything in moderation, including moderation," Mukamal *et al.* (2001), Rehm *et al.* (2003) and Naimi *et al.* (2005) recorded that binge drinking increases risk of myocardial infarction, all-cause mortality, and other harmful outcomes even among otherwise low-risk drinkers. Heavy drinking and binge drinking are also a risk factors for vehicle accidents, crime and injuries from violence (Mukamal *et al.*, 2001; Rehm *et al.*, 2003). Heavy risky alcohol consumption is the cause of individual and societal suffering and morbidity, and negatively affects every human organ system as will be shown in Chapter 3.

The drinking guideline presented by the World Health Organization (WHO) was criticized for not giving due importance to patterns of drinking and not specifying the groups who should abstain from drinking (Rehm & Sempos, 1995). Drinking patterns describe the drinkers (their age, gender, health and other statistics), where they drink (at home, in bars or in public venues) and when they drink (with meals, at social functions and other gatherings). Drinking patterns also include what individuals drink (commercially produced, traditionally or illicitly produced alcoholic beverages), how they consume the drinks (sipping them with meals or binge drinking), and when they drink (whether drinking is concentrated in one sitting or spread out over a lengthy period of time (ICAP, 2004). According to Room and Mäkelä (2000), four types of the cultural position of drinking are distinguished namely: abstinent societies, constrained ritual drinking, banalised drinking and fiesta drunkenness. Drinking patterns offer a valuable tool for examining social, economic and public health relationships, and for addressing the needs of populations whose drinking may put them at particular risk for harm (ICAP, 1997; ICAP, 1998; ICAP, 2001; ICAP, 2003; Stockwell, 2001).

The social, health and economic impact of alcohol consumption and production forced several countries to formulate alcohol policies. Policies governing alcohol abuse have shifted from prohibition to free trade and neither were perfect. Prohibition resulted in prompting illicit

alcohol sales, whereas totally unrestricted access to alcohol has led to hazardous alcohol consumption. Thus, there was a need to develop strategies to reduce or better to eliminate harmful risky alcohol consumption. This resulted in various policies and guidelines called 'sensible' or 'responsible' drinking (Bondy *et al.,* 1999; Stockwell, 2001).

Potential harmful effects of alcohol consumption in many countries are also addressed by dietary recommendations on sensible drinking. There is, however, no information if these recommendations are adhered to. Moreover, in South Africa, there is little known about the consequences and potential beneficial effects of alcohol consumption in the African population

1.2. Aims, objectives and structure of the thesis

The main purpose of this thesis was to explore the consumption of alcoholic beverages and thus alcohol intake of black South Africans, in order to evaluate if the present South African Food Based Dietary Guideline (FBDG) regarding alcohol intake, is relevant and appropriate, or if a new guideline is needed.

To reach this aim, a literature review of alcohol consumption in South Africa, with a focus on historical drinking patterns and present intakes of the African population in transition (from rural to urban areas), forms the starting point of the thesis (Chapter 2).

This is followed by a discussion of the known harmful effects of alcohol consumption (Chapter 3) as well as a summary of the putative beneficial effects of moderate consumption and the mechanisms through which these effects may be mediated (Chapter 4).

To evaluate the appropriateness of the existing FBDG regarding alcohol consumption in South Africa, the concept of FBDGs will be briefly discussed, followed by an analysis of alcohol recommendation in the FBDGs of different countries and regions of the world (Chapter 5). This chapter is presented as an article, submitted for publication in the African Journal of Food, Nutrition and Development (AJFAND).

Because so little is known about the putative beneficial effects of alcohol in African populations, an analysis of alcohol consumption and some health outcomes were applied to subjects of the THUSA study (Transition and Health during Urbanisation of South Africans

study). The results of this analysis are reported in Chapter 6, also in article format. This article has been accepted for publication by the South African Journal of Clinical Nutrition (SAJCN) in 2009.

To examine if a new FBDG on alcohol is needed in South Africa, the information presented in Chapters 1-6 of this thesis, is integrated in a critical discussion in Chapter 7, with recommendations to guide the population towards sensible and responsible drinking.

1.3 Definitions and terminology

In this thesis, the following definitions of the indicated terms are used:

- "***Responsible***" drinking is the use of alcoholic beverages by an individual in such a way that it does not lead to damage a person, or a level at which drinking is unlikely to cause health problems (Banerjee *et al.*, 2006).
- "***Sensible drinking***" means drinking enjoyably, socially and responsibly and avoiding to drink if safety and ill-health are imminent and risky for young people and special groups. Therefore, guidelines on responsible and low-risk drinking define a level and pattern of alcohol use that is not linked with an increased risk of alcohol-related problems for both the adult drinker and for others.
- **"Hazardous or increased risk":** Levels at which there is an increasing risk of problems such as raised blood pressure, stroke, and liver cirrhosis.
- **"Harmful or definitely dangerous"** means that sustained drinking at this level is likely to cause physical, mental and social problems.
- **"Binge drinking"**: Pattern of alcohol consumption that increases blood alcohol concentration (BAC) to over the legal limit of 0.08% or higher for driving a vehicle. This usually corresponds to more than 5 drinks (men) on a single occasion and 4 drinks (women) within a period of 2 hours.
- **"Alcohol abuse"**: A pattern of drinking that causes harm to a person's health, relationships, or ability to work.

- **"Unit":** According to the South African drinking guideline, the daily limit is 4 units and 2 units for men and women respectively (Van Heerden & Parry, 2001). The United Kingdom guideline shows the limit being 3 units per day for men and 2 units per day for women, where a unit is 8 grams or 10 ml of pure alcohol. This is

equivalent to half a pint of beer at 3.5% alcohol by volume (ABV), a small glass of wine at 9% (ABV) or 25 ml of spirits at 40% (ABV). Table 1.1 (adapted from Van Heerden and Parry, 2001) gives the alcohol content of a "standard drink" of South African alcoholic beverages.

Table 1.1. Definition of a standard drink (Van Heerden & Parry, 2001)

Drink	Average alcohol content (% volume)	One drink	Alcohol content (g)
Beer, malt	5	340 ml	12
Beer, sorghum	3	500 ml	12
Stout	6	375 ml	17
Cider	6	340 ml	16
Cooler/flavoured	5-10	340 ml	8
Grape liquor			
Liqueur	30	25ml glass	6
Sherry	17	50ml glass	7
Brandy, whisky	43	25ml tot	11
Gin, cane, vodka	43	25ml tot	11
Wine	12	120ml glass	11

1.4. Ethical considerations

This study forms part of a broader study, "Alcohol: from molecules to society" funded by the South African National Research Foundation (NRF) in a grant to Prof. H. H. Vorster (Grant number, Reference: FA2006041100003). The different sub-studies all received ethical approval from the North-West University Ethics Committee. The THUSA study analysed for this thesis received ethical approval from the previously named, Potchefstroom University for Christian Higher Education, ethics number 4MS-95.

The co-authors of the two articles (Chapter 5 and 6) incorporated in this thesis, written by the candidate, gave permission to use the data for the thesis.

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CHAPTER 2:

LITERATURE BACKGROUND: ALCOHOL CONSUMPTION IN SOUTH AFRICA

2.1. Historical aspects

In South Africa, like all parts of the world, alcohol has been brewed and consumed for ages except in Muslim countries, where it is prohibited for religious reasons (Parry, 2005). Alcohol forms an important part of many cultures. It is served at a variety of ceremonies like births, deaths, marriages, circumcision, ancestral worship and family hospitality (Partanen, 1991). These alcoholic beverages were locally brewed in villages at homes and were almost in a state of continuing fermentation. They had to be consumed quickly to avoid expiration. Malt and sorghum grains were mostly the ingredients for the home-brewed alcoholic beverages. These beverages were cheaper than Western-type beverages (Mager, 2005b).

The white settlers introduced new forms of alcoholic beverages like barley beer, beer, wine and spirits to Southern Africa in the 17th century. The newly introduced alcoholic beverages had longer shelf lives and were available at any time and any place. Therefore, the colonial and post-colonial periods are evidenced by a change in types, patterns and qualities of alcohol intake (London, 1999; 2000; Mager, 2005a). In addition, there was replacement of traditional and locally produced homebrew alcoholic beverages with Western industrial commercial beverages (Scheigart, *et al.,* 1972; London 1999).

Later on, the British colonial government in South Africa restricted selling, purchasing and access of 'alcohol' to the black Africans. The further history of alcohol consumption in South Africa is strongly linked to the history of Apartheid. In this era, prohibited access to alcohol to blacks was legislated (Mager, 2004; Rataemane & Rataemane, 2006). This resulted in increase of sales of homebrews of sorghum beer and traditional beer from illegal outlets called shebeens. Shebeen is defined as " an unlicensed, unconventional drinking establishment where alcoholic beverages are sometimes brewed, and always sold and dispensed at any time that is convenient to the patrons and the proprietors (Qwelane, 1992; Department of Trade and Industry, 1997; Mager, 2005b). Urbanization caused an increase in the number of shebeens and risky drinking, because it was associated with male sociability (Rataemane & Rataemane, 2006). Heavy risky drinking at a shebeen was regarded as smart, loaded with masculine boldness and perceived as beating the law (Qwelane, 1992). In these times, Soweto residents spent more on liquor than on food (Mabiletsa, 1972, Campbell, 1994).

Although blacks regarded shebeens as a form of defiance against the Apartheid rule, alcohol has contributed to the breaking down of the moral fibre of family and community life (Gumede, 1995; Parry & Bennetts, 1998; Mager, 2004). In an attempt to stop the shebeens, the township municipalities built local beer halls selling Tlokwe and Chibuku, which are industrially, produced thick sorghum beers sold in waxed cardboard cartons. Black Africans being used to home-brewed nutritious sorghum beer and treating it as food, drank large quantities of this state brewed beer. In the interest of economy, the mass produced grain beer was gradually stripped of its vitamin and nutritional content by replacement of maize grits for sorghum. Maize was cheaper than sorghum and it was easier to brew (Scheigart *et al.,* 1972). Disorders of malnutrition like pellagra, beri-beri heart disease and cancer of the gullet were common among these heavy drinkers (London, *et al.*, 1998c; Mager, 2004).

The other legacy of Apartheid is the 'dop' or 'tot' system through which farm workers were being paid with alcohol in lieu of wages (London, 1999). This 'dop' system is still posing a major public health challenge in the Cape Province (Peden *et al.*, 2000; Parry, 2005). Peden *et al.* (2000) reported that alcohol remains the substance most commonly abused in Cape Town from the reports of traumatic injuries and death. A 2005 study in the Western Cape Province (May *et al.*, 2005) reported a foetal alcohol syndrome rate of 65-74 per 1000 children in the first–grade population, the highest reported rate for any functional community (an average for a developed country like United States is estimated at 0.79 per 1000). This represents a 60% rise since a study of an earlier cohort in the same area (May *et al.,* 2000; Viljoen *et al.*, 2003).

Another trend recently identified in South Africa is the involvement of the young and women into the risky alcohol consumption culture of all South Africans (Morojele *et al.,* 2006).

In summary, the history of alcohol consumption in South Africa is tightly linked to the history of Apartheid. While the crude cheap wine given to farm workers exacerbated health problems and encouraged addiction, the poor quality of government brewed grain beer contributed strongly to alcohol-related problems including malnutrition. Therefore, Apartheid created an environment in which drinking alcoholic beverages became part of a struggle against "authority", leading to social, economic, family and health problems.

2.2. Consumption patterns at present

South Africans consume over 6 billion litres of alcohol per year (WHO, 2004) which is freely available at approximately 250 000 liquor outlets (Department of Trade and Industry, 1997). The *per capita* consumption of alcohol in South Africa has been estimated between 10.3 and 12.4 litres per annum,

with the higher level reflecting the amount including homebrewed alcohol. Parry (2005; 2006) estimated that *per capita* consumption amongst drinkers in South Africa is higher than the regional average bringing the country to a similar level as European countries. The South African Demographic and Health Survey (SADHS) of 1998 reported that one-third of adults who drink recorded binge drinking over weekends (Parry *et al.*, 2005). Parry and colleagues also noted other harmful patterns of drinking, which included (i) drinking frequently and to intoxication at social events such as weddings and funerals, (ii) sharing and drinking from same container that is passed around, and (iii) drinking in public places like open parks. As stated earlier, they also mentioned that the traditional sorghum beer has been replaced by commercially produced malt beer, wine, spirits, and alcoholic fruit beverages.

2.3. Alcohol and HIV/AIDS

Shisana and Simbayi (2002) reported binge drinking among teenagers and young people that caused unsafe sexual behaviour, resulting in high levels of sexually transmitted diseases, including infection with the human immuno-deficiency virus (HIV), leading to aquired immuno-deficiency syndrome (AIDS). According to Shisana *et al.* (2005), this country is carrying a heavy burden of the disease, with at least 8.2% of South African men and 13.3% of South African women infected with HIV. There are more people living with HIV/AIDS in South Africa than any other country in the world (Shisana *et al.,* 2005). Unsafe sex has been ranked as the second highest risk factor for harm in high mortality developing countries, accounting for 10.2% of the global burden of disease (Rehm *et al.,* 2003). Fritz *et al.* (2002) documented that misuse of alcohol is a determinant of unsafe sexual practice and, therefore, an indirect factor contributing to HIV transmission in Sub-Saharan countries. The study conducted in Gauteng Province among risky drinkers collaborated that heavy drinking is usually accompanied by multiple casual sexual partners and results in sexually transmitted infections and diseases (Morojele *et al.*, 2006).

2.4. Distribution of alcohol consumption in South Africa

An increase in frequent drinking among young black males and female South Africans has been observed by Rocha-Silva *et al.* (1996), and Reddy *et al.* (2003). The South African Demographic and Health Survey (SADHS) (Parry *et al.,* 2005) reported an alarming increase in women drinkers which indicated a decrease in adherence to traditional taboo which prohibited black women from alcohol consumption. It has been reported that approximately 49%-89% of males and 28%-77% of females of

the population consume alcohol. There was a difference by population group and gender, with the highest levels reported by white males (71%) followed by white females (51%), and Coloured males (45%). The lowest rates were reported by African and Asian females (12% and 9% respectively). The highest rates of drinking for both men and women were recorded in urban areas. The people in Gauteng and Free State reported the highest alcohol consumption. A high level of heavy drinking has been reported among disadvantaged communities. The data from the 1998 SADHS clearly indicate a relationship between poverty and alcohol consumption (Table 2.1). The results of the SADHs shown below in Table 2.1 are presented as percentages of males and females reporting drinking, separated by province, urban-non-urban location, population group, age and educational level.

These results do not differ much from the 2008/9 police report. According to the 2008/2009 South African police report, analysis also shows that alcohol abuse is increasing and is a very important factor contributing to murders(www.saps.gov.za/statistics/reports/crimestats, 2008/2009). The highest ratio of assault was recorded in the Northern Cape. The highest incidence of common assault was recorded in the Free State, followed by the Western Cape and Gauteng. The lowest level of common assault was recorded in Limpopo. The highest incidence of all sexual offences was recorded in Gauteng, followed by the Northern Cape and Western Cape, while Limpopo featured at the bottom of the list.

Table 2.1: Percentage of males and females reporting current use of alcohol and percentage of current drinkers engaging in risky drinking

[Adapted from the 1998: SADHS, (Parry *et al.*, 2005)].

Background characteristics	Total samples (5 574 males and 7 962 females)		Current drinkers (2 478 males and 1 321 females)			
	Drink now Current drinking		Risky drinking- weekdays		Risky drinking- weekends	
Age	Males	Females	Males	Females	Males	Females
15-24	23.5	8.5	3.1	1.2	29.3	30.1
25-34	51.8	15.6	8.4	9.1	37.2	33.4
35-44	61.1	21.0	7.5	7.4	39.0	32.4
45-54	60.1	23.5	8.1	14.0	31.7	35.3
55-64	54.2	20.4	7.6	12.5	27.2	31.8
65 years and older	45.8	20.3	6.6	7.0	21.0	30.2
Residence						
Urban	46.7	19.2	6.4	7.1	30.0	29.5
Non-urban	41.4	13.2	8.3	12.9	38.0	39.3
Province						
Eastern Cape	47.5	16.2	6.5	9.8	31.4	33.6
Free State	56.2	24.5	5.6	5.6	27.3	30.0
Gauteng	49.7	20.6	6.1	4.7	24.0	22.1
KwaZulu-Natal	39.8	11.5	8.5	14.2	31.7	37.8
Mpumalanga	45.9	14.2	5.8	8.6	49.4	46.4
Northern Cape	48.5	23.1	6.2	7.7	38.1	48.7
Limpopo	28.3	8.6	11.1	18.1	41.1	45.21
North West	46.6	17.0	9.1	14.9	42.9	43.0
Western Cape	43.6	24.2	6.1	5.4	33.4	30.2
Education						
No education	54.6	22.9	6.9	14.6	36.0	38.6
Sub A-Std 3	50.7	16.3	12.1	11.3	40.3	44.6
Std 4-Std 5	42.0	13.2	10.5	9.5	42.9	44.9
Std 6-Std 9	39.6	12.7	4.7	7.6	30.4	32.5
Std 10	46.7	18.5	6.9	5.9	24.4	18.3
Higher	57.8	33.4	2.0	1.9	24.0	12.6
Population group						
African	41.5	12.3	7.7	13.3	35.7	42.1
African urban	43.6	12.8	6.6	11.3	32.5	40.7
African non-urban	38.8	11.8	9.2	15.3	40.2	43.5
Coloured	44.8	23.2	9.3	4.3	39.2	34.2
White	71.4	50.5	3.4	2.7	18.7	14.0
Indian	37.4	9.0	1.5	0.0	6.1	0.0
Total	44.7	16.9	7	8.8	32.8	32.4

2.5. Alcohol and disease burden

South Africa has been ranked number 47 out of 185 countries with the highest alcohol consumption in the world. Risky drinking is as high as 30% among the adult African urban population (Rehm *et al.*, 2003; Parry, 2005) and also prevalent among poor women of child–bearing age. Many women from poorer socio-economic communities in the Western Cape recorded high alcohol consumption that placed their babies at a risk for foetal alcohol syndrome (Viljoen *et al.*, 2003). Schneider *et al.* (2007) recorded 37 000 deaths in South Africa that were attributable to alcohol. The results the alcohol-attributable disability adjusted life years (DALYs) by cause, and injuries accounted for 63% of the burden. Interpersonal violence accounted for 39%, with 42.8% and 25.9% of the alcohol-attributable DALYs in males and females respectively (Table 2.2).

From Table 2.2 it can be seen that the top rankings in terms of alcohol-attributable DALY's for persons, are homicide and violence (39%), alcohol dependence or use disorders (14.7%) and road traffic injuries (RTIs) (14.3%). Foetal alcohol syndrome (FAS) is ranked 4th and accounts for 5.5% (62 466) of alcohol-attributable DALYs (this despite no deaths attributed to FAS for this study). For years of life lost (YLLs) the top rankings are homicide and violence (45%), RTIs (19.6%) and suicides (5.4%). Nevertheless, in terms of alcohol-attributable years lived with disability (YLD), alcohol use disorders rank first (44.6%), homicide and violence second (23.2%) and FAS third (18.1%). These are followed by epilepsy and RTIs, accounting for 3.5% and 2.3% (Schneider *et al.*, 2007).

2.6. Alcohol and injuries

Table 2.2 indicates that injuries accounted for the largest portion of the alcohol-attributable disease burden in South Africa in 2002. According to the WHO global Comparative Risk Analysis (CRA) study (Rehm *et al.* 2004), the 28% of unintentional and 12% of the intentional injury burden was attributable to alcohol. The South African unintentional injury burden (20.2%) and intentional burden (40.9%) contributed to the burden of South Africa being more similar to the developed countries than to that in Afro-region-E; the high mortality developing region.

A study in Cape Town, examining why twice as many pedestrians as car occupants die in traffic crashes, found that 60% of injured pedestrians had a blood-alcohol level of 60.06 g/dL (0.06%) (Peden, *et al.*, 2000). Seventy six percent of all deaths in South Africa after interpersonal violence have been shown to be alcohol related (Van der Spuy, 2000; Van As, 2004). There is some evidence that the presence of alcohol in the body at the time of injury may be associated with greater severity of injury and less positive outcomes (Meel, 2004; Matzopoulos *et al.*, 2002; 2005). It was reported that

of 11390 blood samples examined for alcohol concentrations (BACs) at autopsy of persons who died of fatal injuries in 2003, half (50.8%) of 6099 individuals whose deaths were linked to violence had evident alcohol levels in their blood with a mean BAC of 0.17 g/100 mL (±SD 0.09 g/100ml). Alcohol is also associated with violent crime and it contributes to aggressive behavior. Parry *et al.* (2005) and Parry and Dewing (2006) showed that in South Africa, 49.3% of the arrestees for domestic violence were reported to have been drinking.

Studies on alcohol-related consequences distinguish between chronic (e.g. cancers) and acute (e.g. accidents) outcomes (WHO, 2000). Table 2.3 shows an overview of alcohol as a risk factor for the global burden of disease and injury, with special emphasis on the alcohol-use disorders - i.e., alcohol dependence and harmful use of alcohol as outlined in *International Statistical Classification of Diseases* (ICD-10) codes (WHO, 2007).

According to the WHO (2002), alcohol-use disorders, especially for men, are among the disabling disease categories for the global burden of disease. These 2002 identified alcohol-attributable diseases and injuries are the same as those in the CRA global burden of disease (GBD) 2007, except that colorectal cancer has been added on the basis of the 2007 assessment of the International Agency for Research on Cancer on the carcinogenicity of alcohol beverages (Fuchs & Chambless, 2007).

Table 2.2 Disease burden attributable to alcohol use in males, females and persons, South Africa, 2000. Adapted from Schneider *et al.* (2000)

	MALES					FEMALES					PERSONS				
	PAF%	Deaths	YLLs	YLDs	DALYs	PAF%	Deaths	YLLs	YLDs	DALYs	PAF%	Deaths	YLLs	YLDs	DALYs
Cancer mouth/pharynx	28.5	283	3353	166	3519	16.4	63	755	30	785	25.2	345	4108	197	4304
Cancer oesophagus	37.2	1289	14743	228	14971	23.0	437	5194	70	5264	32.1	1726	19937	298	20235
Cancer liver	30.3	519	6474	72	6546	17.0	161	1829	24	1852	25.8	680	8303	95	8398
Cancer larynx	42.9	271	2888	0	2888	28.0	30	375	0	375	40.4	301	3263	0	3263
Female breast cancer	0.0	0	0	0	0	5.6	165	2160	165	2326	5.6	165	2160	165	2326
Type II diabetes Mellitus beneficial	-6.4	-301	-3518	-954	-4471	-2.3	-189	-1949	-521	-2470	-3.9	-491	-5467	-1475	-6942
Epilepsy	53.7	968	21591	7688	29279	22.2	208	3446	4492	7938	41.2	1176	25037	12180	37217
Hypertensive disease	26.0	1340	13219	377	13596	12.4	1302	11231	255	11486	17.3	2642	24450	631	25081
Ischaemic heart disease	7.6	1292	11958	768	12726	0.0	0	0	0	0	4.4	1292	11958	768	12726
Stroke harmful	12.3	1635	17422	1331	18753	3.8	631	7234	343	7577	7.5	2266	24656	1674	26330
Stroke beneficial	-1.1	-160	-1409	-284	-1694	-13.0	-2491	-22487	-3308	-25795	-7.9	-2650	-23896	-3593	-27489
Cirrhosis liver	54.6	1932	28209	4836	33046	31.3	651	9358	1433	10791	46.1	2582	37567	6269	43836
Alcohol use disorder/ Dependence	100	550	9489	106973	116462	100.0	210	3563	46536	50099	100.0	760	13052	153509	166561
Depression	3.6	0	0	3591	3591	0.4	0	0	678	678	1.5	0	0	4269	4269
Low birth weight	0.3	19	637	47	685	0.3	16	543	41	584	0.3	36	1181	88	1269
Foetal alcohol syndrome	100.0	0	0	31181	31181	100.0	0	0	31285	31285	100.0	0	0	62466	62466
Road traffic injuries	49.9	4935	123834	6779	130613	29.2	1231	30485	1252	31737	43.9	6166	154319	8031	162350
Poisonings	31.3	67	1814	0	1814	24.4	47	1034	0	1034	28.4	114	2848	0	2848
Falls	21.3	185	3576	1287	4863	7.7	19	282	1375	1657	14.7	204	3858	2662	6520
Fires	51.0	980	24391	4076	28468	46.9	668	14534	2073	10606	49.4	1648	39925	6149	45074
Drownings	56.8	231	6149	0	6149	21.3	21	467	0	467	50.8	252	6615	0	6615
Other unintentional Injuries	5.9	70	1857	4895	6752	0.0	0	0	0	0	4.8	70	1857	4895	6752
Suicides	36.3	1430	36790	7	36797	18.5	244	5429	9	5438	32.3	1674	42218	16	42235
Homicide and violence	47.3	11253	322492	53113	375604	31.1	1488	38946	26855	65800	43.9	12741	361437	79967	441405
Total incl. Beneficial Effects		**28787**	**645958**	**226178**	**872136**		**4912**	**112428**	**113085**	**225513**		**33699**	**758386**	**339263**	**1097649**
95% uncertainty interval Lower		26370	586296	217514	804513		3983	100564	106925	209003		31090	696654	328635	1026986
Upper		30706	701650	234189	935290		6287	128303	116811	242672		36212	817558	347786	1164342
% of total burden (incl. Beneficial effects)		**10.5%**	**11.2%**	**8.4%**	**10.3%**		**2.0%**	**2.3%**	**4.0%**	**2.9%**		**6.5%**	**7.1%**	**6.2%**	**6.8%**
95% uncertainty interval Lower		9.6%	10.2%	8.0%	9.5%		1.6%	2.0%	3.8%	2.7%		6.0%	6.5%	6.0%	6.3%
Upper		11.2%	12.2%	8.7%	11.0%		2.5%	2.6%	4.2%	3.1%		6.9%	7.7%	6.3%	7.2%
Total excl. beneficial Effects		**29248**	**650885**	**227416**	**878301**		**7592**	**136864**	**116914**	**253778**		36840	**787749**	**344331**	**1132079**
95% uncertainty interval Lower		26923	591943	219142	811511		6968	127107	111027	239277		34499	728402	333509	1062852
Upper		31134	707043	235376	942384		8516	149041	120236	268131		38925	846395	352766	1197765
% of total burden excl. beneficial effects		**10.7%**	**11.3%**	**8.4**	**10.4**		**3.1%**	**2.8%**	**4.2%**	**3.3%**		**7.1%**	**7.4%**	**6.2%**	**7.0%**
95% uncertainty interval Lower		9.8%	10.3%	8.1%	9.6%		2.8%	2.6%	4.0%	3.1%		6.6%	6.8%	6.0%	6.6%
Upper		11.4%	12.3%	8.7%	11.1%		3.4%	3.0%	4.3%	3.5%		7.5%	7.9%	6.4%	7.4%

PAFs=population-attributable fractions; YLLs=years of life lost ; YLDs= years lived with disability; DALYs=disability-adjusted life years

Table 2.3. A list of diseases related to alcohol consumption. (Adapted from Schneider *et al.*, 2007).

Health outcomes	ICD-10 codes
Cancers (neoplasms)	
Mouth/oropharynx	C06,C10
Oesophagus	C15
Liver	C22
Larynx	C32
Breast	D05
Cardiovascular diseases	
Hypertensive disease	I10-I13
Ischaemic heart disease	120-I25
Ischaemic stroke(cerebral infarction)	163
Haemorrhagic stroke (intracerebral haemorrhage	I61
Other chronic diseases	
Diabetes (non-insulin dependent)	E11
Cirrhosis of liver	K70, K71, K74, K76
Effects of prenatal alcohol exposure	
Foetal alcohol syndrome	Q86.0
Low birth weight	P07
Neuropsychiatric conditions	
Depression (unipolar major depression)	F32
Epilepsy	D40
Alcohol dependence	Z72
Acute adverse effects	
Intentional injuries	X60-X84, Y87
Unintentional injuries	V01-V99

*ICD codes: International Classification of Diseases

2.7. Alcohol and the economy

From the above discussion it is evident that the burden of disease and injury from alcohol misuse might increase as development takes place in South Africa. According to Parry and Bennetts (1998), the estimated economic cost of alcohol misuse was R9.5 billion per year in 1998 (2% of the Gross National Product), which is approximately three times the amount of revenue received by the government in the form of excise taxes.

The government, in the attempt to control the use of alcohol and raise revenue indirectly to meet social costs related to alcohol misuse, collect excise taxes on alcohol products. Excise duties on alcoholic beverages collected were approximately R4.2 billion in 2003/4 (Van As, 2004). Trying to balance pricing and consumption requires a comprehensive review. It has been calculated that beer and wine sales contribute over R35 billion in turnover and employ over 660 000 people (Van As, 2004). Increasing excise taxes on alcohol will raise revenue for programmes to reduce the social burdens related to alcohol misuse. However, Van As (2004) argues that the level of social cost in South Africa far exceeds that of other countries.

Further large economic and social burdens associated with alcohol misuse occur also as a result of FAS (May *et al.,* 2000). The rate of FAS in South Africa is 18 to 141 times higher than the estimates for the USA (May *et al.*, 2000; 2005). Furthermore, it was reported that motor vehicle collisions cost the country R10.5 billion per year and that approximately 50% are alcohol-related (Department of Trade and Industry, 1997). Clearly, the cost of alcohol misuse should be seen also as an indirect cost, taking its social consequences into account.

2.8 South African drinking guidelines

It is well-known and emphasized by the WHO (2004) that South Africa has been carrying a triple burden of poverty, chronic diseases, and injuries, and now the fourth has been added on by HIV/AIDS. Alcohol misuse has been shown as an aggravating factor. WHO (2002) recommended a strategy to reduce crime and violence could be by reducing the availability of alcohol. The level of drinking in South Africa is harmful and thus the guideline drawn by the South African Food-Based Dietary Guidelines (FBDGs) Work Grouping to attend to the situation is: "If you drink alcohol, drink sensibly" (Vorster, 2001). This guideline was formulated with the acknowledgement that there will always be people in the society who will drink, and that moderate drinking may have beneficial effects (Van Heerden & Parry, 2001). Looking at the current harmful and hazardous use of alcohol in the country, the South African drinking guideline needs re-visiting. Recommendation of total abstinence, or completely prohibition like in Muslim countries, or banning of alcohol consumption, may be the logical solution to the problem. However, these recommendations were put forth in other European countries and met with resistance. It pushed consumers into the unregulated homebrew market and encouraged cross-border smuggling (Mckee & Britton, 1998).

Furthermore, South Africa, like some other countries, introduced health warning labels on the containers of alcoholic beverages to distinguish liquor bottles from others as well as health warnings about alcohol in advertisements in the media such as newspapers, magazine, television and radio. The message warns against drinking and driving and that alcohol is an intoxicant which delays thinking. Age restriction (18 years) has been set for people who can buy or sell liquor. This restriction is also used in advertisement of alcoholic beverages. The strength or concentration of ethanol

'pure alcohol' must be written on all containers (Parry & Dewing, 2006). The success of these warning labels and restrictions on advertising has not been evaluated, despite the fact that the result of the increase in the burden of disease attributable to alcohol is undeniable and cannot be ignored. The behaviour of the South African population in exceeding the recommended alcohol levels, drinking to intoxication and not drinking sensibly is a matter of concern.

The WHO study ranked countries on a four point scale in terms of whether the pattern of drinking was hazardous or not and South Africa falls into the group of countries exhibiting the most hazardous pattern of drinking (Rehm *et al.*, 2003a; Parry, 2005). Clearly, the present FBDGs as well as the restrictions of advertisements of alcoholic beverages are not associated with "sensible" drinking in the South African population.

2.9. Discussion

It was mentioned that the government has placed several policies in place to reduce the hazardous use of alcohol (Parry & Dewing, 2006). These strategies might be complemented by a suitable, drinking guideline which may bring change in behaviour of drinkers. At present, the existing FBDG about alcohol consumption seems not to be adequate.

Dufour (2001) discussed the merits of objectives related to levels of alcohol consumption as set out on Substance Abuse of Healthy People 2010. The goals included: reduction of the proportion of persons engaging in binge drinking, reduction of average annual alcohol consumption, and the reduction of adults who exceed guidelines for low-risk drinking. In addition, they included reducing the rates of alcohol-related deaths and injuries from motor vehicle collisions, reducing the death due to cirrhosis, reducing the percentage of adolescents using alcohol, reducing the prevalence of episodic drinking in both adolescents and adults, and reducing average annual per-capita alcohol consumption. Lastly, they specified that there should be a decrease in customary drinkers exceeding guidelines.

South Africans should take heed of these goals and emphasis should be placed on implementation. There is a legal blood alcohol level set for drivers in South Africa which also reinforces the adherence to the recommended drinking guidelines.

However, as mentioned previously, the present FBDG recommending "sensible drinking" seems not to be effective, because of high levels of alcohol abuse in South Africa as indicated. Unfortunately, it is not known how well the FBDG on alcohol has been implemented. Awareness and knowledge of this guideline have not been assessed. However, the warning to drink sensibly and responsibly is brought to the attention to the total South African public via the media (warnings seen on television and printed media).

In the next two chapters (Chapters 3 and 4) a closer look at the harmful and beneficial effects of alcohol consumption will be done in an attempt to motivate a more effective FBDG for alcohol consumption.

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CHAPTER 3:

HARMFUL CONSUMPTION

3.1. Introduction

Alcoholic beverages have always been part of human culture and the result of risky drinking has been reported in the story of Noah in the Bible (Genesis 9: verses 20-25). Worldwide, the industry of alcohol brewing, consumption and sale generates profits and employment for governments, farmers, breweries, and advertisers; but the estimated annual costs that are attributed to misuse of alcohol are very high in all countries except Muslim countries. In 2004, 3.8% of all global deaths were attributable to alcohol, 6.3% for men and 1.1% for women. The difference between the sexes in mortality is an indicator of the difference in drinking, with respect to both overall volume and heavy drinking occasions (Lopez *et al.,* 2006). In the same year, 4.6% of the global burden of disease and injury was attributable to alcohol: 7.6% for men and 1.4 for women (Lopez *et al.,* 2006).

As will be shown in Chapter 4, moderate alcohol consumption may be beneficial, but what determines "moderate" depends on age, sex, genetic characteristics, coexisting illnesses, and other factors (White *et al.,* 2002). There is no doubt that the average volume of alcohol consumption and the pattern of drinking, especially occasions involving heavy risky drinking, affect health (Rehm *et al.,* 2003a; Rehm *et al.*, 2004).

3.2. Mechanisms that modulate the harmful effects of alcohol consumption

According to Babor (2003), three mechanisms explain alcohol's ability to cause medical, psychological and social harm: (i) physical toxicity (ii) intoxication and (iii) dependence. The interrelationships between these three mechanisms and their consequences are illustrated in Figure 3.1. For the purpose of this discussion, "binge drinking" is defined as bouts of heavy alcohol consumption leading to intoxication (WHO, 1999, Rimm *et al.*, 1999), and takes place usually over weekends (see paragraph 3.6).

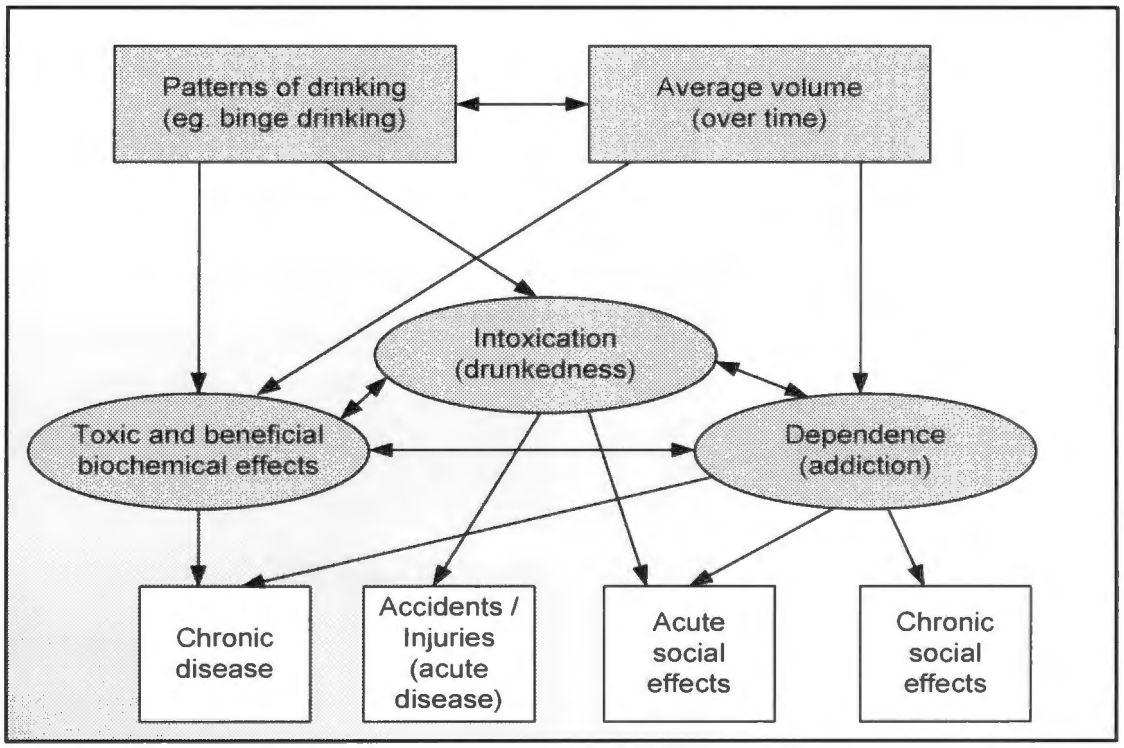

Figure 3.1: Conceptual model of alcohol consumption. Relationships among alcohol consumption mediating factors and alcohol-related consequences (Adapted from Babor, 2003).

The mechanisms of toxicity, intoxication and dependence are associated with the patterns of drinking. Regular and risky heavy alcohol consumption patterns such as binge drinking promote chronic health problems such as liver cirrhosis, cardiovascular disease and psychological diseases. Furthermore, high volumes of alcohol intake that lead to raising blood alcohol levels result in problems related to acute intoxication, such as accidents, injuries, violence and crime. Ultimately prolonged heavy drinking might result in alcohol addiction or dependence. The social consequences of alcohol abuse shown in Figure 3.1 are listed in the diagnostic criteria of alcohol abuse given in the Diagnostic and Statistical Manual on Mental Disorders, (DSM-IV) (American Psychiatric Association, [1994] (Rehm, 2001). The DSM-IV defines alcohol abuse as alcohol consumption that results in:

- Failure to fulfill major obligations at work, school, or home (e.g., repeated absences or poor work performance, neglect of children or household)

- Continued drinking even in situations where it is physically hazardous (e.g., driving an automobile or operating machinery)
- Recurrent alcohol-related legal problems (e.g., arrests for disorderly conduct while drinking)
- Continued drinking despite persistent or recurrent social or interpersonal problems it may cause (e.g., arguments with spouse, physical fights).

The harmful effects of alcohol on productivity, injuries, violence and disease will now be discussed in more detail.

3.3. Workplace productivity

Researchers usually examine workplace injuries, absenteeism, job performance and turnover when evaluating the effect of alcohol consumption on productivity. Frone (1999) reported that alcohol dependence, alcohol abuse and heavy drinking lower productivity. An U-shaped association between sickness absence and both the frequency of heavy drinking and the weekly quantity consumed were reported for men by Marmot *et al.* (1993). A Soul City (Soul City, 2009) publication reported that people who drink may miss work and could also have accidents operating machines and special tools (Soul City, 2009). There is a strong association between alcohol consumption and poor work performance. However, many factors other than alcohol abuse affect work performance for example, shift work, boredom on the job, repetitive tasks and workload (Gmel *et al.*, 2001), and should be taken into account when assessing the relationship between workplace productivity and alcohol abuse.

3.4. Alcohol and injuries

3.4.1. Introduction

The World Health Organization (2000) reports indicate that 37–43% of road injuries world-wide are attributable to alcohol, as are one in five water/air transport injuries, 15–35% of injuries from falls, 38–45% of fire injuries, 23–38% of drownings, 7–25% of occupational/machine injuries and 24–47% of injuries from assaults (WHO,2000).

Watt *et al.* (2004; 2005) found that acute consumption of any type of alcohol significantly increases the risk of injury compared with not drinking, independent of age, gender, socio-economic status, substance use and situational variables such as activity and location.

Injuries may be divided into two categories: unintentional injuries, including road traffic injuries, drowning, burns, poisoning and falls; and intentional injuries, which result from deliberate acts of violence against oneself i.e. self-inflicted injury (including suicide) and injuries resulting from interpersonal violence, foetal alcohol syndrome, child neglect, sexually transmitted diseases and unintended pregnancies (Room & Rossow, 2001).

The relationship between heavy alcohol consumption and all types of unintentional injuries such as traffic accidents, accidents in professional and recreational contexts, falls, and accidental arson, have also been recorded in several studies (Cherpitel, 1993; 1995; Eckhardt *et al.*, 1998; Hingson & Howland, 1993; Hingson *et al.*, 1996).

3.4.2. Interpersonal violence

Room and Rossow (2001) mention that numerous mechanisms link alcohol and interpersonal violence. It has been argued that the pharmacological effects of alcohol impair judgment, reduce attention to costs and consequences of one's actions, reduce self-control, interfere with self-awareness, and increase psychological and physiological arousal. These make drinkers more likely to resort to violence in conflicts and reduce ability to recognize warning signs in potentially violent situations (Dermen & George, 1989; Room & Rossow, 2001; Steele & Josephs, 1990). High alcohol consumption leads to risky, unsafe sexual and delinquent behaviour resulting in sexually transmitted diseases, unplanned pregnancies and prenatal alcohol exposure, resulting in foetal alcohol syndrome or foetal alcohol effects (Pithey & Morojele, 2002). High percentages of violent assaults between partners have been preceded by alcohol consumption (Room & Rossow, 2001). For at least half of these assaults and violence cases, there is a causal relationship with alcohol misuse, and drinking has been documented as a risk factor for both the perpetrator as well as for the victim (Soul City, 2009).

3.4 3. Alcohol consumption and the family

There is evidence that alcohol use increases the occurrence and severity of domestic violence. Heavy drinking leads to broken homes, neglecting family and misusing money meant for family use (Soul City, 2009). Alcohol has been recognized as one of the major factors in verbal abuse and physical violence in most families (Jewkes *et al.*, 2002; Gil-González *et al.*, 2006).

3.5 Alcohol and diseases

3.5.1 Introduction

Alcohol is closely associated with many major disease outcomes, mainly in a harmful and injurious way. Heavy alcohol consumption can adversely affect every organ system and was found to increase risk for the following major chronic diseases: mouth and oropharyngeal cancer; oesophageal cancer; liver cancer; breast cancer; unipolar major depression; epilepsy; alcohol use disorders; hypertensive disease; hemorrhagic stroke; and cirrhosis of the liver (Pöschl & Seitz 2004; Pöschl *et al.*, 2004).

According to the Global Burden of Disease (GBD) study, the following categories of diseases and disorders were related to alcohol use (Table 3.1).

Table 3.1: Diseases and disorders associated with heavy risk alcohol consumption. Modified from Standridge *et al.* (2004).

Diseases and disorders associated with heavy risk alcohol consumption	
Neurological disorders	**Malignancy (Cancer)**
Intoxication	Oral and pharyngeal
Addiction	Laryngeal
Withdrawal syndrome	Oesophageal
Seizures	Stomach
Delirium tremens	Breast
Wernicke-Korsakoff syndrome	Liver
Alcoholic cerebellar degeneration	Colon
Peripheral neuropathy	**Haematologic disorders**
Ischaemic stroke	Bone marrow suppression
Intracranial haemorrhage	Nutritional and blood loss anaemia
Cardiac disorders	Immune system disorders
Hypertension	Impaired immune system
Cardiomyopathy	More frequent infections and complications thereof
Arrhythmias	**Psychiatric disorders**
Hepatic dysfunction	Psychiatric co-morbidities are exacerbated
Cirrhosis	Suicide risk increases
Alcoholic hepatitis	**Other disorders**
Gastrointestinal disorders	Sleep disturbance
Gastritis	Sexual dysfunction
Oesophagitis	Obstructive sleep apnoea
Duodenitis	Periodic limb movement disorders
Peptic ulcer disease	Accidents and injury (to self and others)
Pancreatitis	
Musculoskeletal disorders	
Alcoholic myopathy	
Osteoporosis	
Fall and fractures	

3.5.2. Alcohol and cancer (Malignancy)

3.5.2.1. Evidence for an alcohol cancer relationship

According to the International Agency for Research on Cancer (IARC, 1988), there is evidence from epidemiological and experimental studies that chronic alcohol consumption is a risk factor for cancer of the upper aerodigestive tract, including the oral cavity, oropharynx, hypopharynx, and oesophagus, of the liver in the presence of cirrhosis, and of the large intestine and the breast (Key *et al.*, 2004). Seitz *et al.*

(2004) and Brown (2005) have supported an association between increasing alcohol consumption and increased risk of colorectal cancer. Alcohol has also been considered to cause an increased risk of cancer of certain other organs, such as the stomach, lung and cervix (Bagnardi *et al.*, 2001). Some studies have reiterated that a relationship exists between cancers of the upper digestive tract and distilled spirits (Pöschl & Seitz, 2004).

3.5.2.2. Possible mechanisms of carcinogenesis

Many studies agree that the amount of alcohol is not the only determinant for organ injury, and that genetic and environmental factors may modulate and determine organ damage or carcinogenesis. It has been shown that acetaldehyde, a metabolic product of alcohol, together with various other factors contribute to alcohol-associated cancer development rather than only alcohol itself. The amount of acetaldehyde to which cells or tissues are exposed after alcohol ingestion has been shown to be of great significance and may, among others, influence carcinogenesis (Seitz *et al.*, 2001; Seitz *et al.,* 2004; Pöschl *et al.,* 2004). Evidence has pointed out that acetaldehyde is responsible for the alcohol-associated carcinogenesis because acetaldehyde is carcinogenic, mutagenic, binds to DNA and protein, destructs folate, and results in secondary hyperregeneration. Acetaldehyde is produced by various alcohol dehydrogenases in the liver and in the gastrointestinal tract and by gastrointestinal bacteria. Acetaldehyde is degraded by aldehyde dehydrogenase to acetate which is metabolised in the Krebs-cycle. Both generation and degradation of acetaldehyde are modulated because of polymorphisms or mutations of the genes responsible for the enzymes involved (Seitz & Meier, 2007). In addition, cigarette smoke and some alcoholic beverages also contain acetaldehyde.

3.5.3. Cancers of the upper aero-digestive tract

Chronic alcohol consumption and heavy smoking are the major risk factors for cancer of the upper aero-digestive tract, including the oropharynx, hypopharynx, larynx and esophagus. Alcohol has a carcinogenic dose–response effect at sites of the upper aero-digestive tract, which is independent from smoking, and in some studies, smoking and alcohol have been found to interact in a multiplicative fashion (Bagnardi *et al.*, 2001; Seitz *et al.* 2004).

3.5.4. Liver cancer

Chronic excessive alcohol consumption can lead to liver cirrhosis, which can develop into hepatocellular carcinoma (Boffetta & Hashibe, 2006). Corrao *et al.* (2004) reported a relative risk of 1.8 for carcinoma for the heaviest consumers (100 g/ day). However, the direct correlation between alcohol consumption and the development of hepatocellular carcinoma is not straight-forward, as the disease does not develop in all patients with cirrhosis.

3.5.5. Breast cancer

A large number of epidemiological studies indicate that alcohol intake increases the risk of breast cancer, and the risk rises with increasing consumption of alcohol, even in small amounts such as one drink per day (Corrao *et al.*, 1999; Bagnardi *et al.*, 2001). Breast cancer is the result of a complex process in that hereditary susceptibility, age, oestrogen metabolism, tobacco smoke and alcohol consumption constitute recognised risk factors. The increase in hormones such as oestrogen and androgens in alcohol-consuming women, dietary factors such as low folate intake, use of hormone replacement therapy and enhanced mammary gland susceptibility to carcinogenesis have been examined in trying to explain the mechanisms. It seems that the interaction of multiple factors contribute to breast cancer development.

3.5.6. Colorectal cancer

Cho *et al.* (2004) reported a positive association between alcohol consumption and risk of colorectal cancer. Their meta-analysis indicated a dose–response effect with alcohol intake of about 30 g/day (3 drinks) increasing the risk of colorectal cancer. Two other meta-analyses reported an increased risk from about 2–3 drinks per day (Bagnardi *et al.*, 2001; Longnecker *et al.*, 1990; 1995). Acetaldehyde is probably responsible for colorectal carcinogenesis like in all cancers.

3.5.7. Alcohol and old age

A number of elderly people participate in heavy alcohol consumption and it has been noted that these individuals are more sensitive to the toxic actions of ethanol. Interactions between alcohol and drugs that are frequently taken by the elderly may result in increased hepatotoxicity. Thus, elderly individuals should be extremely cautious when they drink alcohol (Seitz & Stickel, 2007). For example, the combination of aspirin and ethanol is harmful to the gastric mucosa and results in haemorrhagic gastritis and bleeding (Meier & Seitz, 2008). Furthermore, the physiological effects of alcohol on the ageing body manifest as alterations in alcohol absorption, hepatic alcohol metabolism, excretion of alcohol and cerebral susceptibility to alcohol toxicity (Meier & Seitz, 2008).

Lastly, it has been noted that the elderly are more prone to accidents due to their reflexes being reduced with age and this condition may be exacerbated by alcohol consumption.

3.6. Binge drinking

An old adage by Mark Twain goes: "Everything in moderation, including moderation." However, studies prove that even an irregular episodic drinking presents a health risk. Binge drinking has adverse consequences on cardiovascular physiology and thrombosis/fibrinolysis and contributes to sudden cardiac death related to ventricular arrhythmias (Mukamal *et al.,* 2005). Furthermore, indirect evidence from studies found that there is a high increase in sudden cardiac deaths at weekends and on Mondays, which is an indirect indicator for binge drinking on the weekends (Chenet *et al.,* 2001). In the Ukraine, binge drinking has been linked to illness and premature death (Charles *et al.,* 2005). Alcohol dependence and regular binge drinking proved to play a role in causing liver cirrhosis (Wetterling *et al.*, 1999; Kamper-Jorgenesen *et al.,* 2004). Liver cirrhosis seems to be exacerbated by spirits consumption, spirits being consumed at high concentrations of ethanol (Mann *et al.,* 2003). Heavy drinking, especially a risky binge pattern of drinking is linked to a higher incidence of cerebral thrombosis, cerebral haemorrhage and coronary artery disease deaths. Heavy alcohol intake decreases testosterone in men (Ylikahri *et al.,* 1974; Van Thiel & Lester, 1979).

Binge drinking in South Africa is now recognized as the normative pattern for consumption among young people (Parry, 2006). This pattern of drinking being more harmful than regular moderate drinking should, therefore, be addressed in advice to the population regarding alcohol consumption.

3.7. Conclusion

An extremely high proportion (55-74%) of trauma and psychiatric patients in South Africa report alcohol abuse as identified by admission and discharge diagnoses reported by acute psychiatric facilities (Parry *et al.*, 2002). Another study showed that alcohol was associated with minor psychiatric comorbidity including depression, anxiety, and somatic complaints in South Africans (Peltzer, *et al.* 2001). One study found that up to 23% of black or Coloured South African arrestees were under the influence of alcohol at the time of the alleged offense (Parry, *et al.*, 2004).

Alcohol is highly correlated to many diseases and many negative social consequences, as indicated in this chapter. Of concern is the exacerbated harmful effects of binge drinking, and the indications of high levels of binge drinking in South Africa. Clearly, this problem needs to be addressed more aggressively.

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CHAPTER 4:

POTENTIAL BENEFICIAL EFFECTS OF ALCOHOL.

4.1. Introduction

The brewing and sale of alcohol generates employment and profits to the government and members of communities. In addition, alcoholic beverages may contribute to nutrition, and moderate consumption has shown to have beneficial effects on some health indicators. These will be discussed in more detail.

4.2. Alcohol and nutrition

Alcohol is considered as beneficial nutrition that may extend the quality of life and enhances a gracious and joyful lifestyle, as well increasing potential cognitive effects in enhancing creativity and therapeutic impacts in times of stress (Poikolainen ,1999; Poikolainen *et al.,* 1996).

Moderate alcohol consumption may increase intakes of some nutrients, either because of the contribution of nutrients found in alcohol (such as B vitamins in beer), or because of interactions between alcohol and nutrients. For example, Walmsley *et al.* (1998) report higher intakes of B vitamins with increasing alcohol consumption, which was partially explained by the high content of certain B vitamins in beer. The traditionally home-brewed sorghum beer has a high nutritional value and it is usually regarded as food (Van Heerden & Parry, 2001). Serfontein *et al.* (2009) reported that the diets of heavy drinkers in the THUSA study met recommended intakes of pantothenic acid, biotin and zinc, which were inadequate in other groups. Van Heerden and Parry (2001) calculated the nutritional content of sorghum beer brewed from sorghum malt, using unrefined sorghum as a starchy adjunct (Table 4.1). They compared the nutrient content of sorghum beer to that brewed using refined maize grits. The percentage contributions of nutrients by one litre of the respective beers to the South African recommended dietary allowances (RDAs) (Government Gazette, 1977), and the estimated safe and adequate daily dietary intake (ESADDI) (National

Academy of Sciences, 1989) for manganese and the estimated minimum requirement (EMR) for potassium as specified in the USA for adults (National Academy of Sciences), are also shown.

Table 4.1. Comparison of the nutritive content of sorghum beer brewed with refined maize grits and unprocessed sorghum as starch adjunct (Van Heerden & Parry, 2001)

	Maize grits adjunct		Sorghum adjunct	
Nutrient	Nutritive content/ Litre	%RDA/ ESADDI/ EMR	Nutritive content/ Litre	%RDA/ ESADDI/ EMR
Energy (kJ)	1 475	12.3	1 695	14.1
Protein (g)	5.4	9.6	5.2	9.3
Total fat (g)	Trace	0	Trace	0
Carbohydrate (g)	41.9	-	39.9%	
Ethanol % (ml/ml)	2.31	-	3.20*	-
Thiamin (mg)	0.58	38.7	0.96*	64.0
Riboflavin (mg)	0.41	24.1	0.47	27.6
Nicotinic acid (mg)	3.03	15.9	5.58	29.4
Calcium (mg)	53	6.6	52	6.5
Magnesium (mg)	94	23.5	178*	44.5
Phosphorus (mg)	150	18.8	305*	38.1
Iron (mg)	1.26	7.0	3.44*	19.1
Zinc (mg)	1.63	10.9	1.94*	12.9
Copper (mg)	0.17	5.7	0.27*	9.0
Manganese (mg)	0.88	25.1	1.83*	52.3-
Sodium (mg)	21	<1	18	<1
Potassium (mg)	217	10.9	407*	20.4

*Significant difference between adjuncts (P<0.05).
RDA=recommended dietary allowances;(Govt Gazette, 1977) ESADDI=estimated safe & adequate daily dietary intakes (National Academy of Sciences, 1989) EMR= estimated minimum requirement.
KJ=Kilojoules; mg=milligrams

Commercially mass produced grain beer has been stripped of its vitamin and nutritional content in the interest of economy by the substitution of maize grits for sorghum. Concoctions are made with additions of sorghum malt/powder beer, brown bread, sugar and baker's yeast to increase the alcohol from the 3.0% ml/ml restriction. Nonetheless, alcohol is the second highest source of energy, on a per gram basis, of all the macronutrients, providing 29 kJ/g (7 kcal/g). Most alcoholic beverages contain only small amounts of nutrients – primarily carbohydrate and very small amounts of protein. Beer also contains small amounts of some micronutrients, primarily B vitamins and some minerals, and wines contain traces of some minerals including iron, potassium, copper and sodium.

Alcohol contributes mainly energy to the diet (except for some traditional home-brewed beverages). In heavy drinkers (10-30% or more of total energy from alcohol), alcoholic beverages displace other foods that normally provide essential nutrients (Truswell, 2007). It may also suppress appetite, mostly because of alcoholic gastritis (Truswell, 2007). Heavy drinkers often display deficiencies of B-vitamins: thiamin, folate, niacin and several other micronutrients (Truswell, 2007). Therefore, the few potential beneficial effects of alcohol on nutrient intakes are overshadowed by detrimental effects in heavy drinkers, leading to possible malnutrition.

4.3. Possible health benefits of alcohol

4.3.1. Cardioprotective effects of alcohol

O'Keefe *et al.* (2007) compared alcohol consumption to the proverbial double-edged sword that is capable of cutting so deeply in either direction depending on how it is used. Light to moderate alcohol consumption reduces total mortality compared with non-drinking and part of this benefit is a reduction in coronary artery disease (CAD) deaths, including sudden cardiac death. Heavy risky drinking is associated with increase in mortality, including an increase in cerebrovascular cases. Most studies report a U-or-J-shaped curve, to illustrate the relationship between alcohol consumption and morbidity and mortality. Light to moderate alcohol drinkers have less risks than abstainers, and heavy drinkers are at the highest risk (Marmot & Brunner, 1991; Murray *et al.*, 2002). Moderate alcohol intake is associated with lower risks of ischaemic stroke (Rimm *et al.*, 1999; Klatsky, 1999; Agarwal, 2002; Mukamal *et al.*, 2005) and dementia (Mukamal *et al.*, 2003). Most of the prospective cohort studies indicate that alcohol, when used in moderation, has an antiatherosclerotic effect (Srivastava *et al.*, 1994; Rotondo *et al.*, 2001).

Several factors have been proposed to explain the beneficial effects of moderate alcohol consumption on the development of coronary heart diseases (CHD) and atherosclerosis. Existing information suggests that moderate alcohol consumption confers cardiovascular protection mostly through enhancement of insulin sensitivity and elevation of high-density lipoprotein cholesterol (HDL-C). According to Rimm and colleagues (1999), a 16.8% reduction in CAD is directly attributable to increased

HDL-C from consuming 30 g alcohol per day, i.e., alcohol consumption increases HDL-C levels in a dose-dependent fashion. The mechanism whereby alcohol improves insulin sensitivity appears to involve suppression of fatty acid release from adipose tissue. According to Greenfield *et al.* (2003), this reduction in fatty acids decreases substrate competition in the Krebs-cycle of skeletal muscles, thereby facilitating glucose metabolism. Low-to-moderate alcohol consumption is also associated with lower rates of the metabolic syndrome (Gigleux *et al.*, 2006).

These studies have further suggested that alcohol may mediate additional cardioprotective effects by promoting fibrinolysis through changes in the activity, levels or interaction of one or more components of the fibrinolytic system (tissue plasminogen activator [t-PA], urokinase type plasminogen activator [u-PA], plasminogen activator type 1 [PAI-1], plasminogen [Pmg] and fibrinogen) (Agarwal, 2002; Delahousse *et al.*, 2001; Ridker, *et al.* 1994;). Moderate alcohol intake favourably affects coagulation profiles (Rimm *et al.* 1999), in particular through its effects on platelet aggregation (Delahousse *et al.*, 2001; Ridker *et al.*, 1994). A meta-analysis of 42 publications confirmed the influence of alcohol both on lipids and on blood-clotting factors (Rimm *et al.*, 1999).

The beneficial effects of alcohol on the cardiovascular system will be summarised from recent reviews and large epidemiological studies:

- **Reduced myocardial infarction mortality**- Abramson *et al.* (2001) showed that increasing levels of moderate alcohol consumption are associated with a decreasing risk of heart failure among older persons. Another study has found that individuals who consume one alcoholic drink every 1 to 2 days have a lower risk of a first acute myocardial infarction (AMI) than abstainers or heavy drinkers (Mukamal *et al.*, 2001). The studies suggested that the main factor was daily alcohol consumption. Type of alcohol or consumption with meals did not affect the level of risk (see 4.4 for possible mechanisms).

- **Reduced heart failure-** The highest reduction of heart failure risk in people who consumed one and one-half to four drinks per day was reported by Abramson *et al.* (2001). This benefit was observed in the subjects in the Framingham Heart Study where men who consumed 8 to 14 alcoholic drinks per week were at a lower risk for congestive heart failure (Walsh *et al.*, 2002). Observational studies have consistently demonstrated a reduction in coronary

heart disease risk with light-to-moderate alcohol consumption (Gaziano *et al.,* 2000). Coronary heart disease plays an important role in the development and progression of heart failure in many patients (Camargo *et al.,* 1997). However, it is not known whether preexisting left ventricular dysfunction confers an increased susceptibility to the cardiotoxic effects of alcohol.

- **Reduced risk of ischaemic stroke-** As indicated by Gaziano *et al.* (2000), Numminen *et al.* (1996), Reynold *et al.* (2003) and Sacco *et al.* (1999), cerebrovascular disease includes conditions giving rise to inadequate blood supply to the brain. Stroke results from the severe disruption of cerebral blood supply, due either to blockage of a blood vessel (ischaemic stroke), or rupture of a blood vessel (haemorrhagic stroke). The relationship between alcohol consumption and stroke may be explained by the biological mechanisms by which alcohol use might influence the risk of cerebrovascular disease. Alcohol-related hypertension may increase the risk of both forms of stroke; the antiatherogenic effects of alcohol consumption may decrease the risk of ischaemic stroke, while the antihaemostatic effects may increase the risk of haemorrhagic stroke and decrease the risk of ischaemic stroke (Mukamal *et al.*, 2005). Sacco *et al.* (1999) showed the alcoholic protective effect in younger and older populations, in men and women and in all racial and ethnic groups. A J-shaped relationship between alcohol consumption and stroke risk was demonstrated with reduced risk at up to two drinks per day. Reynolds *et al.* (2003) found a J-shaped association between alcohol consumption and the relative risk of total and ischaemic stroke and a linear association between alcohol consumption and the relative risk of haemorrhagic stroke in their meta-analysis. Moderate alcohol consumption was associated with a reduced relative risk of total and ischaemic stroke, while heavy alcohol consumption was associated with an increased relative risk of total, ischaemic and haemorrhagic stroke. Stampfer *et al.* (1988) showed that moderate alcohol consumption (5 to 14 g of alcohol per day) was associated with a decreased relative risk of ischaemic stroke.

4.3.2. Decreased risk of dementia

Ruitenberg *et al.,* (2000) found that, in a population of individuals aged 55 years or older, those who consumed up to three glasses of alcohol per day had a lower risk of dementia and vascular dementia than those who never drank alcohol. More evidence for a protective effect of moderate alcohol consumption against the development of dementia is suggested by Zuccala *et al.* (2001) and Mukamal *et al.* (2003b). According to Ruitenberg *et al.* (2000), the source of alcohol consumed (beer, wine, liquor or fortified wine) did not affect the change in the results which is in contrast with the studies of Orgogozo *et al.* (1997) and Truelsen *et al.* (2002) which emphasised the protective effect of only wine in reduction of dementia. Alcohol drinking in middle age showed a U-shaped relation with risk of mild cognitive impairment in old age. Risk of dementia increased with increasing alcohol consumption only in those individuals carrying the apolipoprotein E4 allele (Anttila *et al.,* 2004), illustrating a possible genetic effect in response to alcohol consumption.

4.3.3. Decreased risk of developing diabetes

Low-to-moderate alcohol drinkers showed lower risk than non-drinkers, occasional drinkers and heavy risk drinkers for developing type 2 diabetes (Koppes *et al.,* 2002; Wannamethee *et al.*, 2002; Wei *et al.,* 2000). Men with a high alcohol intake may be able to reduce their risk of developing type 2 diabetes if they drink less. According to Carlsson *et al.* (2003), moderate daily consumption of alcohol lowers the risk of developing type 2 diabetes. Low-to-moderate alcohol consumption is reported to be associated with beneficial effects on insulin and glucose levels and on insulin sensitivity (Davies *et al.*, 2002).

The metabolic syndrome is a disorder characterised by abdominal obesity, dyslipidaemia, hypertension and elevated fasting blood glucose. The beneficial effects of light-to-moderate alcohol consumption on specific components of the metabolic syndrome suggest that alcohol consumption may help prevent the development of the metabolic syndrome as a whole.

4.3.4. Decreased risk of developing osteoporosis

Turner (2000) reported a beneficial effect of light to moderate alcohol consumption in the skeletal system in older women. He explained that this putative beneficial effect may be due to a reduction in the age-related increase in bone remodelling associated with postmenopausal bone loss. According to Turner *et al.* (2001), alcohol might reduce bone loss in postmenopausal women by increasing the circulating levels of oestrogen. Alternatively, alcohol might slow bone loss by acting on bone cells to reduce bone remodelling. Women who consumed 75g or more of alcohol per week were found to have higher bone densities at the lumbar spine compared with abstainers. This relationship was observed in both current users and non-users of hormonal replacement treatment (Feskanich *et al.*, 1999). Naves *et al.* (1997) demonstrated a reduced risk of vertebral deformity in women 65 years and older who consumed alcohol more than 5 days per week compared with those who drank less.

4.3.5. Stress reduction and mood elevation

Wilson (1998) and Peele and Brodsky (2000) mentioned that moderate alcohol consumption has been recognised as an aid to relaxation and the lessening of the symptoms of stress, not only by popular accounts but also by scientific writers such as Wilson (1998), Hauge & Irgens-Jensen (1990) and Peele and Brodsky (2000). It is well established that moderate use of alcohol improves mood, enhances feelings of happiness, and freedom from care, and decreases stress, tension and depression. Significant increases in cognitive performance as well as improved short term memory also occur. Moderate alcohol consumption is also related to a self-perception of good health.

4.3.6. Beneficial effects on blood haemostatic factors

Alcohol has a beneficial effect on platelet aggregation and the thrombin level in blood is higher among drinkers than among non-drinkers (Renaud & De Lorgeril, 1992). Moderate alcohol intake decreases clot formation and regular moderate alcohol consumption has no significant effect on fibrinolysis in contrast to heavy alcohol consumption (Mukamal *et al.*, 2001; Van Golde *et al.*, 2002). Moderate alcohol

consumption decreases fibrinogen levels (Sierksma *et al.,* 2002), plasma viscosity, von Willebrand factor, and factor VII (Mukamal *et al.,* 2001). As mentioned in 4.3.1, these effects may be related to the cardioprotective effects of alcohol.

4.4. Mechanisms of alcohol benefits on the vascular and hormonal systems

Metabolic factors and biomarkers that explain the beneficial effects of low-to-moderate alcohol consumption consist of an increase in high density liporotein-cholesterol, an increase in plasminogen activator (t-PA) without a compensatory increase in plasminogen activator inhibitor type 1 (PAI-1), a decrease in fibrinogen levels, and decreased platelet aggregation (Agarwal, 2002; De Oliviera *et al.*, 2000; Hannuksela *et al.,* 2002; Hines *et al.*, 2001; Rimm *et al.*, 1999; Sillanaukee *et al.,* 2000). Supplementary beneficial changes in biologic markers involve decreases in insulin levels and resistance, C-reactive protein, endothelin-1 synthesis and activation of sirtuins (Corder *et al.,* 2001; Davies *et al.,* 2002; Howitz *et al.*, 2003; Sierksma *et al.,* 2002; Stewart *et al.*, 2002). These proposed mechanisms are summarised in Table 4.2 (data adapted from Agarwal, 2002).

Table 4.2. Proposed biological mechanisms underlying cardio-protection by low-to-moderate alcohol consumption. Adapted from Agarwal (2002)

Variable	**Cardioprotective effect of alcohol consumption**
Lipid and lipoprotein profile=Anti-atherosclerotic	Increases "good" HDL-cholesterol
	Reduces oxidation of harmful "bad" LDL-cholesterol
	Increases paraoxonase activity
	Reduces platelet aggregation
Haemostatic function=Anti-thrombotic	Reduces fibrinogen levels
	Increases fibrinolysis
	Increases coronary blood flow
Cardiovascular system	Reduces blood pressure
	Decreases plasma homocysteine levels

HDL=high-density lipoprotein; LDL= low-density lipoprotein

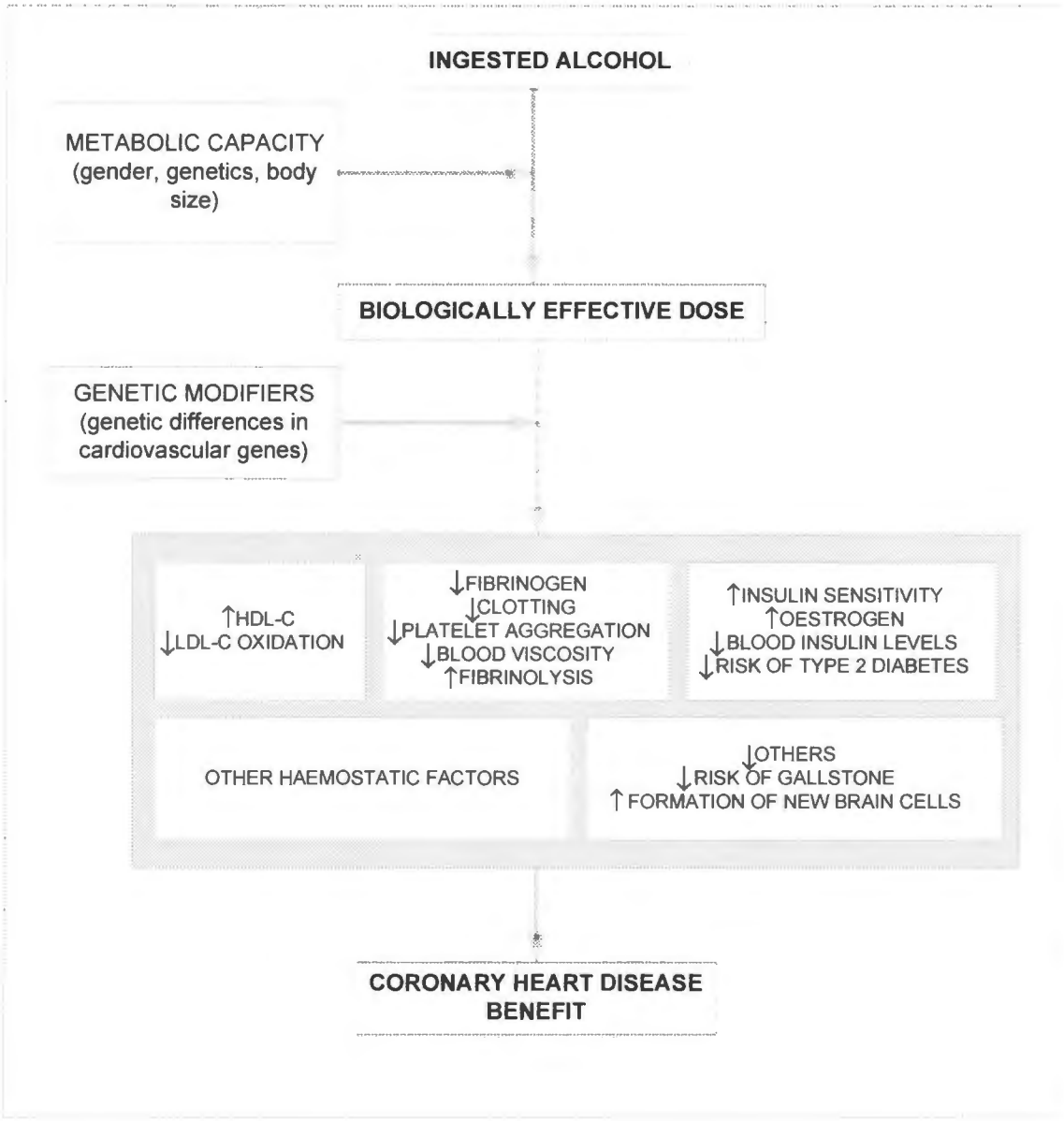

Figure 4 1. Mechanisms by which moderate alcohol consumption exerts its beneficial effects on the cardiovascular system. Adapted from Agarwal, 2002.

(CHD=coronary heart disease; HDL=high density lipoprotein).

The proposed mechanisms by which moderate alcohol consumption may benefit the cardiovascular and hormonal systems are illustrated in Figure 4.1 and will be briefly summarised from the publication of Agarwal (2002). It has been suggested that the cardio-protective effect of alcohol depends on the drinkers' age and gender and on the pattern the alcohol is consumed; irregular heavy drinking, with meals or without meals, or regular moderate drinking. The type of alcoholic beverage may be another

of these factors. Agarwal (2002) categorised the beneficial effects of alcohol consumption as follows:

- **Increased high-density lipoprotein cholesterol**

Subjects who drink alcohol have higher serum levels of high-density lipoprotein and lower of low-density lipoprotein than abstainers. Thus, high-density lipoprotein has been suggested to be a mediator of 40–60% of the effect of alcohol on ischaemic heart disease (Hines *et al.,* 2001; Suh *et al.*, 1992). This increase in HDL has been postulated to be a major mechanism whereby alcohol benefits the heart. Hines and Rimm (2001) showed that genetic variations may modify the relationship. They proved that moderate alcohol drinkers who are homozygous for the alcohol dehydrogenase Type 3 gene have a higher level of HDL and a lower incidence of myocardial infarction.

- **Decreased insulin levels and insulin resistance**

An increase in alcohol consumption decreases the insulin level and insulin resistance index while fasting glucose levels remain unchanged. According to Arima *et al.* (2002), alcohol changes and decreases the close relationship between insulin resistance and the incidence of hypertension and improves insulin sensitivity. Similar results were obtained for normal-weight, overweight, and obese individuals in an experiment whereby moderate alcohol intake (30 g/day) reduced fasting insulin concentration by 19.2%, reduced triglyceride concentration by 10.3%, and increased insulin sensitivity by 7.2%. Davies *et al.* (2002) hypothesised that moderate alcohol consumption might "reduce the risk of developing type 2 diabetes and cardiovascular disease in that population of women".

- **Decreased C-reactive protein**

Moderate alcohol consumption resulted in lower levels of white blood cell counts and inflammatory markers including fibrinogen and C-reactive protein compared with heavy drinking and non-drinking (Imhof *et al.*, 2004). Maraldi *et al.* (2006) collaborated this finding in the study of 2487 subjects where

moderate drinkers with high baseline interleukin-6 had significant reduction in all-cause mortality.

- **Increased activity of Sirtuins**

Experiments showed that the polyphenol present in wine, resveratrol, seems to stimulate the activity of sirtuins, a group of protein deacetylases that regulate lifespan by extending cell survival (Goldberg, 2003; Howitz *et al.*, 2003). In yeast cells, resveratrol imitates calorie restriction by stimulating human deacetylase SIRT1, increasing DNA stability and extending lifespan by 70% (Howitz *et al.*, 2003).

- **Decreased endothelin-1 synthesis**

Red wines strongly inhibit the synthesis of endothelin-1, a vasoactive peptide that is crucial in the development of coronary atherosclerosis (Corder *et al.*, 2001). Red-wine extract is also known to elicit endothelium-dependent vasodilation and lower blood pressure which may provide further protection against coronary heart disease. The findings indicate that remarkably small amounts of red-wine extract can suppress endothelium synthesis: assuming adequate absorption of the active component, they support assertions that a moderate intake of red wine can prevent coronary heart disease. Characterisation of the vascular mechanisms underlying red wine's beneficial effects should help in the design of strategies to prevent atherosclerosis.

4.5. The influence of type of alcoholic beverage

Several studies have suggested that ingredients of alcoholic beverages other than ethanol might explain the beneficial effects on coronary heart diseases risk, especially in the case of wine (Klatsky *et al.*, 1992; 2003). Grønbaek *et al.* (2000) showed that people who drank 8 to 21 glasses of wine per week had a relative risk of death of 0.76, whereas those with low-to-moderate consumption of beer or spirits showed only a small effect on all-cause mortality. The researchers further proved that wine drinkers also had a lower mortality from cancer compared with

those who did not drink wine. The above findings differed from those of Mukamal *et al.* (2001) which recorded that wine, beer and liquor all appeared to confer benefits.

Gaziano *et al.* (2002) found lower levels of markers of inflammation among moderate consumers of either wine or beer, even though the effect seen was slightly more pronounced among wine consumers compared to beer drinkers. Marmot (2001) gave three probable reasons why wine drinkers seem to enjoy more benefits than beer or spirits consumers: (i) wine contains bio-phenols and other substances other than alcohol, (ii) they normally have higher socio-economic position (ii) the pattern of drinking wine differs from the pattern of drinking other beverages.

4.6. The influence of drinking pattern and recommended amounts

Several findings suggest that drinking pattern - regular moderate versus binge drinking - may play a role in the apparent cardio-protective effect of alcohol. Tolstrup *et al.* (2003; 2006) showed an increased benefit in association with increase in the frequency of drinking, that is, optimal benefit was noted in men who drank daily and also women who drank one day per week had lower risk of developing coronary artery disease than women who drank less frequently. According to Mukamal *et al.* (2003), neither the type of alcoholic beverage nor its relation to meals had a significant impact on reducing the risk of nonfatal myocardial infarction or fatal coronary heart disease.

Different opinions were raised by Trevisan *et a.* (2001; 2004) who found higher risks for people drinking outside of meals compared to those who drank mainly with meals and snacks, again after adjustment for age, education, and volume of alcohol consumed. Potential physiological mechanisms include a reduced gastric absorption of ethanol when consumed with meals (Foppa *et al.*, 2002; Grønbaek & Mørch, 2005).

According to Bagnardi *et al.* (2004), the nadir (level of alcohol consumption at which all-cause mortality rate ratio is lowest) and the upper protective dose are 6-7 and 60 g/day, respectively for men and 5-6 and 47-51 g/day, respectively for women. Alcohol consumption is expressed in 'drinks' or 'units' that vary with beverage type, culture and era (Agarwal, 2002). Alcohol drinking may be divided into 'light'- 'moderate' (<30 g/day) and 'heavy' (>30 g/day) categories, depending upon the amount of alcohol

consumed in terms of pure ethanol per day (Dufour, 1999). Cardioprotective alcohol intake is generally defined as 1-2 drinks for men and 1 drink per day for women (Mukamal *et al.,* 2005). A drink in this publication is estimated to be 13g to 15g ethanol.

4.7. The influence of age and gender

Several studies have shown that the effect of alcohol on cardiovascular disease may be modified by gender and age. Di Castelnuovo *et al.* (2006) showed that there was a difference in response by gender in the experiment showing the relationship between alcohol dosing and total mortality. The volume of up to four drinks per day in men was protective, and only up to two drinks per day in women was protective. The possible explanation for the differences is that women have lower gastric alcohol dehydrogenase activity which is responsible for alcohol metabolisms and women on average have smaller bodies and body water volumes. Klatsky *et a*l. (2003) reported that liver cirrhosis, unnatural death and tobacco-related cancers were more common in heavy drinkers and the risk was even higher in women and people aged more than 50 years.

The estimated relation between average volume of alcohol consumption and all-cause mortality was almost linear for individuals below age 45 (Rehm *et al.,* 2001; Gmel *et al.*, 2003).

A recent meta-analysis of 28 cohort studies by Corrao *et al.* (2004) found a 20% decreased risk for coronary heart disease among light to moderate drinkers, and that risk increased among heavy drinkers. They further found that the apparent cardio-protective effect of alcohol is different among men and women.

4.8. French paradox

The evidence discussed above from epidemiological studies that suggested that moderate wine (in particular red wine) consumption is associated with reduced CHD-related mortality (Renaud & De Lorgeril; 1992; Booyse & Parks; 2001) leads to a phenomenon which is called the "French paradox". The famous "French paradox"

represents the paradoxical situation in the Mediterranean region where despite the high intake of dietary cholesterol and saturated fat, mortality from CHD is approximately 40% lower than in other industrialised countries.

Several meta-analyses support the protection of the light-to-moderate alcohol intake against CHD (McClure, 1993, Corrao *et al.,* 2000), but this association is not observed in all populations (Hart *et al.,* 1999; Fuchs *et al.,* 2002). Both Sempos *et al.* (2002) in a nationally representative sample and Fuchs *et al.* (2004) in a large community-based study found cardio-protective effects for whites, but not for black Americans. The investigation found higher rates of all-cause mortality with higher alcohol intake and no apparent beneficial association with moderate consumption (Sempos *et al.,* 2003). The authors hypothesised that the lack of benefit might be due to the binge pattern of alcohol consumption common among blacks as recorded by Dawson (1998). More evidence that the alcohol benefits are not universal came from a large study on Russian men and women, which found no evidence of a J-shaped curve in relationships between average volume of alcohol consumption and mortality. Instead, no beneficial effect appeared and mortality risk actually increased with average intake of more than one drink a day (Sempos *et al.,* 2003; Nicholson, 2005).

4.9. Conclusion

From Chapters 3 and 4, it is clear that the harm of heavy risky alcohol consumption is well documented. Heavy drinkers should reduce their consumption, and change their pattern of drinking, for example, drink during or with meals or better stop drinking. On the other hand, in comparison with abstainers, moderate drinkers are at much lower risk of cardiovascular disease and certain other diseases and have lower total mortality. Thus, as indicated by ICAP (2001) "*middle-aged or older men and post-menopausal women with no contraindications to alcohol use should be informed that they have, on average, net health benefits from the regular consumption of low-to-moderate amounts of alcohol and follow the drinking guidelines".*

However, the question remains whether heavy drinkers and binge drinkers will be able to comply with these recommendations. Also, it should be noted that protective effects of moderate alcohol consumption have not been convincingly demonstrated in the African population. The study of Fuchs *et al.* (2004) particularly demonstrated that cardio-protective effect of alcohol was not seen in black Americans. Therefore, more research is needed before the above recommendations could be made with confidence to the African population.

4.10. References

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CHAPTER 5

DIETARY RECOMMENDATIONS FOR ALCOHOL CONSUMPTION: A NARRATIVE REVIEW

Abstract:

The purpose of this paper is to review food-based dietary guidelines (FBDGs) as a vehicle to guide populations towards responsible and sensible drinking of alcoholic beverages.

The problems with alcohol policies are briefly discussed and the option to use FBDGs as a way to recommend about alcohol consumption stated.

Of the 75 countries for whom FBDGs could be found, 56 included a guideline on alcohol consumption. These guidelines varied from explicit advice not to drink, to warnings not to drink during pregnancy and breastfeeding, to drink sensibly, responsibly or moderately, with some countries advising on age restrictions for drinking or giving amounts (units) that are compatible with good health.

A discussion of drinking patterns in different countries indicated that present alcohol consumption in many do no reflect the advice given in the FBDGs.

It is concluded that at least in South Africa, a guideline "not to drink" may be indicated.

5.1. Introduction

Policy making has been defined as the process by which governments translate their political vision into programmes and actions to deliver outcomes. Most countries aim to reduce the harm caused by alcohol misuse, particularly by reducing consumption among heavy drinkers and among young people. Only Sweden, Ireland and the USA explicitly state the goal of reducing total consumption (Room *et al.*, 2005; WHO, 2005).

Babor *et al.* (2003) explained that designing alcohol policy is particularly problematic because alcohol use is long established and it can play an important role in social

and economic activities. It is reported that Sweden has a long tradition of restrictive alcohol policies, and she acknowledges the measures proposed need to be acceptable to the whole population. Wagenaar (1994) argued that success of the United States in raising the minimum drinking age to 21 years, shows that potentially unpopular measures can be implemented.

WHO (1999) proposed to reduce total consumption of alcohol to six litres per person per year. Currently all of the countries studied, except Muslim ones, exceed the recommended figure and most do so by more than 25% (WHO Department of Mental Health and Substance Abuse, 2004a). The lack of commitment may well reflect what Babor *et al.* (2003) has described as "the economic and political values of free trade, unfettered marketing and open access to alcohol".

Studies pertaining to alcohol consumption have revealed that the United Kingdom, United States of America and Australia were the first countries to adopt a formal general method for determining guidelines for low-risk drinking (ICAP, 1996). The United Kingdom and United States drew almost similar dietary guidelines giving a broad purpose to "define diets which can help reduce the risk of chronic disease, and to address alcohol as one of the many dietary factors to be considered (International Center for Alcohol Policies (ICAP), 1996).

Alcohol consumption is an important risk factor for morbidity, mortality and social harm worldwide (Room *et al.*, 2002; Rehm *et al.*, 2003b; Rehm *et al.*, 2004; WHO, 2004b). In spite of the scientific acknowledgement that alcohol consumption poses serious health, social and economic problems, there are still some countries that have no alcohol guideline, policy or programme to help respond to the challenge to reduce consumption. Furthermore, most of the available guidelines have opted for a level consistent with reducing harm rather than maximizing benefits, although adequate evidence is provided for both purposes. The purposes of alcohol guidelines are to provide levels of risks and also to define a level at which the risk of all-cause mortality increases significantly.

One way of reaching populations, groups of people and individuals with recommendations regarding alcohol consumption, is through an alcoholic beverage guideline as part of food-based dietary guidelines.

5.2. Food-Based Dietary Guidelines

Food-Based Dietary Guidelines (FBDGs) are defined by the World Health Organization (WHO), Food and Agricultural Organization (FAO), as "the expression of principles of nutrition education mostly as foods" (WHO/FAO, 1996; 1998). FBDGs can also be defined as science-based policy recommendations in the form of guidelines for healthy eating (EFSA, 2008). Poor diet is one of the four factors, the others being physical inactivity, tobacco and alcohol use responsible for epidemiology of chronic and non-communicable diseases (NCDs). NCDs kill more people every year globally than any other cause of death. To educate people and policy-makers about healthy diets, FBDGs have been promoted by the WHO as part of national food and nutrition policies in response to the Plan of Action endorsed at the 1992 International Conference on Nutrition (FAO, 1992). The FAO/WHO consultation on FBDGs recommends that dietary guidelines be based on, and aim to improve dietary practices and prevailing diet-related public health problems (FAO/WHO; 1996). Furthermore, the guidelines are expected to reduce famine and famine-related deaths, starvation and nutritional deficiency diseases, as well as micronutrient deficiencies like iodine and vitamin A. According to Smitasiri and Uauy (2007) and Wahlqvist (2009), FBDGs are regarded as the primary instruments to translate and improve optimum nutrition and health. Graphical representations of the FBDGs as food guides may be developed to facilitate communication to consumers.
The aim of the FBDGs is to bring mean population intakes nearer to nutrient goals (Gibney & Sandstrom, 2001). Therefore, FBDGs should aim to educate the population, to guide national food and nutrition policies, and to influence the food industry to market healthy choices. Dietary guidelines are designed in a practical method to reach nutrition goals sets for the population, while considering the setting, social, economic and cultural factors as well as the physical and the biological background.

FBDG should have certain characteristics to be successful. The report of the joint FAO/WHO consultation in 1996 suggested the characteristics given in Table 1 as the as criteria for developing FBDGs (FAO/WHO 1996; Gibney & Sandstrom, 2001; Vorster, 2001; Koenig, 2007; EFSA, 2006/2008; Wahlqvist, 2009).

Table 5.1: Suggested characteristics of FBDGs to be effective and successful.

- FBDGs should address prevalent public health nutrition problems in a country;
- FBDGs must address total diet, and not advise on nutrients or individual foods;
- FBDGs should reflect food patterns and not numerical nutrient goals. The reason being that people eat food, not nutrients;
- FBDGs should reflect that various dietary patterns can be consistent with good health;
- FBDGs should address both over- and under-nutrition and emphasise the joy of eating.

FBDGs should be practical

- Recommended foods or food groups should be affordable, attainable, widely available and accessible, even for food insecure communities; Therefore, a set of FBDGs should enable the rich and the poor to choose and consume a healthy balanced diet;
- FBDGs should recognise the social, economic, sustainable agriculture and environmental conditions affecting foods and eating patterns in a country;
- FBDGs should be flexible, include and reflect an awareness of the modern developments in food technology like fortified foods without promoting over-processed foods responsible for increasing obesity (Monteiro, 2009).

FBDG should be marketable

- FBDGs should be based on scientific evidence of food and health relationships; and therefore create trust and credibility by all;
- FBDG messages should be short, simple, clear, memorable and easily understood by the general public, keeping in mind levels of literacy;
- Food groups that make sense to the target group should be chosen;
- Visual presentation as a "Food Guide" must be easily understood, unique and culturally acceptable.

FBDGs should be culturally acceptable

- FBDGs should be sensitive to ethnic, religious, cultural, and philosophical principles and values of all groups;
- FBDGs could be used to promote eating and production of indigenous and traditional foods;
- FBDGs should address country-specific nutrition-related public health problems;
- FBDGs should not recommend radical changes in current traditional eating patterns; they must be realistic and lead to palatable, acceptable, enjoyable, eating patterns and bring diversity and variety into the diet so as to meet nutrient needs.

Source: Modified from Koenig (2007)

5.3. The South African food-based dietary guidelines

A multidisciplinary group consisting of delegates from academia, the Nutrition Society of South Africa (NSSA), the Association for Dietetics in South Africa (ADSA), Medical Research Council (MRC), Department of Health (DoH), United Nation' Children's Fund (UNICEF), agricultural sector, and an observer from FAO developed a set of FBDG to guide South Africans over the age of 5 to choose a balanced prudent diet. Considering that existing guidelines were nutrient-based and meant for a population eating Western diets, qualitative FBDGs based on addressing nutrition-related public health problems were formulated (Vorster, 2001).

The 11 short, clear, comprehensible messages are:

- Enjoy a variety of foods
- Be active
- Make starchy foods the basis of most meals
- Eat plenty of fruit and vegetables
- Eat dry beans, peas, lentils and soya often
- Meat, fish, chicken, milk and eggs can be eaten every day
- Eat fats sparingly
- Use salt sparingly
- Drink lots of clean, safe water

- If you drink alcohol, drink sensibly
- Use food and drinks containing sugar sparingly and not between meals

Keller and Lang (2006) observed that while the FBDGs are accepted as an important part of nutrition policy, food security is still a major problem. Thus the FBDG can only form part of a larger strategy aimed at combating hunger and deficiencies, but also encouraging economic sustainability. Therefore, it would be important that, for example, the national Integrated Nutrition Programme, the Agricultural Policies for Household Food Security and Poverty Alleviation Programme are consistent with the FBDG. It is generally advised that FBDGs should form the backbone of nutrition education in all countries.

5.4. Global alcohol guidelines

As already mentioned, there are many ways to implement policies to guide a population towards responsible or sensible drinking, of which dietary recommendations, often as a message in a set of food-based dietary guidelines (FBDGs) may be one method. The purpose of this section of the paper is to analyse the FBDGs of different countries regarding recommendations on alcohol consumption, and to evaluate if these guidelines are consistent, relevant and possibly effective.

The FBDGs and the dietary reference values (DRV) for different countries were found through a computer search of the relevant literature and supplemented by attention to all references in the selected articles. The search process involved combining the keywords "global food-based dietary guideline", "alcohol recommendation', "DRV' (dietary reference values).
In Table 5.2 the alcohol recommendations in the FBDGs of different countries are given, as well as an indication if no mention of alcohol is made.

5.5. Results

The search for alcohol recommendations included in the FBDGs, showed that of the 52 European countries, 10 countries do not have any FBDGs, 37 countries do have FBDGs, 3 countries do have dietary reference values (DRV) and 31 countries have alcohol recommendations (ICAP, 2007; WHO, 2000). The African search showed that only three countries have FBDGs with alcohol recommendations. Of the 14 Asian Pacific countries, 10 of these countries included alcohol recommendations in their FBDGs. In Latin America, 9 countries do have alcohol recommendations out of the 17 countries with FBDGs.
Three countries in North America (United States, Canada and Mexico) have FBDGs with alcohol recommendations (ICAP, 2003; ICAP, 2007; WHO (CINDI, 2000).

As can be seen in Table 5.2, most countries, if there are FBDGs, make a recommendation regarding alcohol intake. These recommendations vary from:

- If you don't drink; don't start (avoid)
- If you drink, drink sensibly (moderately; limit intake)
- Children under the age of 18 (sometimes younger than 15) should not drink
- Alcohol is forbidden during pregnancy and lactation
- If amounts are recommended, it is usually translated to 1-2 drinks (unit) of alcohol for women/day and 2-3 drinks (units) for men/day. A unit varies from 10g to 15g of alcohol. The Netherlands' recommendations take body weight of thin women into account.
- Singapore and Hong Kong have alcohol unit recommendations per week: 30 g per week and 21 units per week for men and women respectively. The other countries in Asia Pacific recommended moderate alcohol consumption and Australia included a policy which recommend that pregnant women should abstain.
- The Irish guidelines recommend that alcohol should be taken with meals and that every second day should be an "alcohol-free" day.
- Recommendations to limit during driving, operating machinery, and during old age, are given in some guidelines.

Table 5.2: Alcohol recommendation in sets of FBDGs of different countries and regions (Adapted from ICAP, 2003; 2007; WHO, 2000; 2003).

Country	Presence of FBDG and a Food Guide	Year	Alcohol recommendation
European countries			
Armenia	Yes		No alcohol recommendation.
Austria	Pyramid		No more than 24g pure ethanol per day, 16g pure ethanol per day for men and women respectively. In addition the hazardous limit is defined as 40g/60g alcohol.
Bosnia and Herzegovina	Yes	2003	No alcohol recommendation.
Bulgaria	Yes	2005	Not more than 20g alcohol/day and it is presented as the quantity of beer, wine and spirits containing this quantity.
Croatia	Yes	2002	If you drink, drink in moderation, not more that 2 drinks or 20g alcohol/day.
Czech Republic	Yes	2005	Max. 20-30g alcohol/day, max. 3 times/ week (men and women), the recommendations are for adults (over18), who are healthy (without disease) and not engaged in risky behaviors or taking medication.
Denmark	Yes	2005	<5% of daily intake:<14 drinks per week (women), <21 drinks per week (men). The National Board of Health recommends that children under the age of 15 should not drink.
Estonia	Yes	1998	If you drink, do it in moderation. Moderate consumption is 2 portions for men and 1 portion for women. (Portion: 10-12g pure alcohol). Pregnant and lactating women should not consume alcohol.
Finland	food circle, pyramid, food plate	2005	15g/day (women), 20g/day (men), pregnant women should refrain from alcohol. (165g/week and 110g/week for men and women respectively).
France	Yes	2002	According to National Program for Health and Nutrition (PNNS): Those who drink should reduce their consumption. Pregnant women should not drink. Do not drink and drive. Men and women not to exceed 20g alcohol/day.
Georgia	Yes	2005	33dl/day alcohol.
Germany	food plate		Men: 20g alcohol/day (=0.5/ beer/0.25/ wine/0.06/ spirit) women: half as much.
Greece	Pyramid	1999	Consumption of alcoholic beverages equivalent to about 30g ethanol and 15g (3 servings and 1½ servings per day among men and women respectively).
Hungary	Yes	2002	If you do not drink, do not start, if you drink limit 1 or 2 unit/day (women/men). Alcohol is forbidden for children and pregnant women.
Iceland	Yes	2002	Pregnant women and women who are breastfeeding are advised to abstain from alcohol.
Ireland	Pyramid	1995	If you drink alcohol, keep within sensible limits. Preferably, drink with meals and try to make every

			second day an alcohol free day.
Israel	Pyramid	2003	"Alcohol consumption not a public health problem in Israel". Recommendations for particular populations: pregnant women should not drink; students should avoid drinking more than one unit at a time; avoid alcohol if taking medication.
Italy	Yes	2003	Wine: 450ml/day for men and 350ml/day for women to be divided between lunch and dinner. Avoid consumption during child-bearing age, pregnancy, breastfeeding and reduce it when in old age. Avoid alcohol before driving or when using dangerous machinery or if undergoing drug therapy.
Latvia	Yes	2002	Max. 0.5l/day of beer, 0.25l/day of wine; 0.6l/day of spirits.
Lithuania	DRV	2000	If you drink, take not more than 2 drinks/day(one drink=10g of alcohol).
Luxembourg	Yes	1999	Health authorities promote moderate alcohol consumption without specifying limits of daily or weekly intake that should not be exceeded; individuals are advised to refrain from drinking when driving. Children and adolescents under 16 years of age and young drivers are the main target groups of these health messages.
Malta	Yes	2001	
Moldova	DRV	1992	
Netherlands	Yes	2005	Advised not to drink at least 2 days within a week. Avoid alcohol when pregnant, driving or operating machinery and if an adolescent. Women with a low body weight are advised to drink less than the recommended daily limit (39.6g alcohol/day for men and 19.8g alcohol/day for women.
Norway	Yes		Situational abstinence is recommended, such as when driving, during pregnancy, at work or in the company of children and young people.
Poland	DRV	2001	If alcohol is consumed, limit intake to not more than 2 drinks (each containing 10g alcohol) per day. Eliminate alcohol from diet of pregnant women and children and adolescents up to 20 years.
Portugal	Yes	1997	Based only on wine consumption; 2-3 units/day (28-42g/day) for men; 1-2 units/day (14-28g/day) for women.
Romania	Yes	1992	Not to exceed 32.5g beer/day or 20.7g wine/day for men and women.
Russian Federation	Yes	2002	
Slovakia	Yes	1995	Limit alcohol intake.
Slovenia	Yes	1995	If consumed, limit alcohol intake to not more than 2 drinks (each containing 10g of alcohol) per day
Spain	Yes, pyramid	2000	Alcohol abstinence is recommended for children, pregnant and breast-feeding women, people with high intake unable to moderate, people with alcohol dependence, ill people for whom alcohol worsens their health, people taking pharmaceutical drugs, everyone while at work or driving. Wine officially considered as an integral part of a Mediterranean diet. (Not to exceed 3 units/day (30g alcohol/day)
Sweden	Yes	2005	Not to exceed 20g alcohol/day. It is recognized that a moderate alcohol intake may have certain positive medical effects.
Switzerland	Yes, pyramid		Not to exceed 2 units/day (24g/day). Not to exceed 4 units/event, not to exceed 1 unit/hour. No

			alcohol for youngsters; no alcohol during sports; no alcohol while operating machinery or before driving. Women have to be particularly cautious.
Yugoslavi Republic of Macedonia	Yes	2001	Moderate alcohol consumption 5.6g alcohol /day
Turkey	Yes	2004	Not recommended, but if a person drinks, then 10g alcohol/day.
Ukraine	Yes	2000	No information
United Kingdom of Great Britain & Ireland	Yes	1995	Advises women who are pregnant or who are trying to get pregnant to drink no more than 1-2 units of alcohol per week. Recognize that moderate drinking for men over 40 and postmenopausal women confer health benefits including, lower risk of coronary heart disease, ischemic stroke and gallstones. (3-4 units/day (24-32g/day) not to exceed 21 units/week (168g/week) for men 2-3 units/day (16-24g alcohol/day) not to exceed 14 units/week (112g/week).
Uzbekistan	Yes	2003	
37 countries have FBDG, 3 have DRV; 31 have alcohol recommendation			
AFRICA			
Namibia	Yes	2000	Avoid drinking alcohol.
Nigeria	Yes,	2001	If you must drink, take alcohol in moderation. Avoid drinking alcohol when driving a vehicle or operating any machinery.
South Africa	Yes	2004	If you drink alcohol, drink sensibly.
3 countries have FBDG with alcohol recommendation			
Asia Pacific			
Australia	Yes, plate		If you drink alcohol, limit your intake.
Bangladesh	Yes,		No information
China	Yes, pyramid	1997	For those who consume alcohol, be moderate.
Indonesia	Yes	1995	Avoid drinking alcoholic beverage.
India	Yes, pyramid	1998	Do not use alcohol and tobacco.
Japan	Yes		No information .
Malaysia	Yes, pyramid	1999	No information.
Nepal	Yes,	2004	No information.
New Zealand	Yes	2002	If you drink alcohol, do so in moderation.
Philippines	Yes, pyramid	2000	For a healthy lifestyle and good nutrition, avoid drinking alcoholic beverages.
Singapore	Yes, pyramid	1993	For those who drink, limit alcohol intake to not more than 2 standard drinks a day (about 30g alcohol).
Thailand	Yes, pyramid	2005	National Dietary Guidelines state: Avoid or reduce the consumption of alcoholic beverages.

Hong Kong	Yes, pyramid		Not to exceed 3-4 units/day, not to exceed 21 units/weeks for men; not to exceed 2-3 units/day, not to exceed 14 units/week for women.
Korea	Yes		Restrict smoking and drinking alcohol.
14 Countries	14 FBDG; 10 have alcohol recommendation		
Latin America and the Caribbean			
Argentina	Yes	2000	Moderate alcohol consumption is recommended, youth, adolescents, pregnant and lactating women are prohibited from alcohol drinking.
Bolivia	Yes	2000	Avoid excessive consumption of sugar and alcohol.
Brazil	Yes, pyramid	2002	No information.
Chile	Yes, pyramid		No information.
Colombia	Yes	1999	Drink moderately
Commonwealth of Dominica	Yes,	2007	If you use alcohol do so in moderation.
Cuba	Yes, plate		No information.
Dominican Republic	Yes,		Drink moderately
Ecuador	Yes, pyramid	1999	No information
Grenada	Yes, plate	2006	Drink little or no alcohol.
Guatemala	Yes,		No information.
Mexico	Yes, plate	2000	No information
Panama	Yes, pyramid	1997	No information
St. Lucia	Yes,	2007	If you drink alcohol, do so in moderation.
St. Vincent and the Grenadines	Yes, plate	2006	If you use alcohol do so sparingly both in drinking and in food preparation.
Uruguay	Yes, plate	1998	No information
Venezuela	Yes,	1990	Moderate consumption.
17 FBDGs; 9 have alcohol recommendation			
North America			
Canada	Yes, four-banded rainbow		Limit salt, alcohol and caffeine; include no more than 5% of total energy as alcohol, or 2 drinks daily, whichever is less.
United States of America	Yes, pyramid	2005	Alcoholic beverages should be avoided by individuals, including those who cannot restrict their alcohol intake, women of childbearing age.
Mexico	Yes, pyramid		

FBDG=Food-Based Dietary Guideline; DRV= Dietary Reference Values

5.6. Discussion

Guidelines for intake of alcohol during pre-pregnancy and pregnancy

Heavy and risky alcohol consumption has been reported to affect reproduction in women, influencing the ability to conceive and the possibility of conception (Dees *et al.,* 2001; Goldberg 2002). It is also acknowledged that heavy drinking by pregnant women results in foetal alcohol syndrome, while other foetal alcohol effects may occur at lower levels. It has also been revealed that chronic heavy consumption of alcohol has a harmful effect on the absorption and utilisation of folate. Adequate folate intakes are important before and during the first 12 weeks of pregnancy to protect the fetus against neural tube defects (Williamson, 2006).

The search has further revealed that the following countries: Estonia, Finland, France, Hungary, Iceland, Israel, Italy, Netherlands, Norway, Poland, Spain, United Kingdom and Argentina, have official recommendations on the use of alcohol by pregnant women, namely that pregnant women are advised to abstain from alcohol.

The search for FBDGs in Africa resulted in three countries (Namibia, Nigeria and South Africa) having guidelines that include alcohol recommendations. These guidelines had no official recommendation on the use of alcohol by pregnant women, probably because separate guidelines for pregnancy exist.

The advice included in the United State is: 'Women who are trying to conceive or who are pregnant should not drink'. The Canadian recommendation states that 'alcohol can damage the foetus throughout pregnancy, not just the first trimester' (ICAP Report 6, 1999).

- ***Alcohol and breastfeeding***

Alcohol can pass to an infant in small amounts through breast milk. Most guidelines recommend abstinence from alcohol consumption for breastfeeding women and others suggest that they should keep below the daily limit of 2 to 3 units, and avoid drinking alcohol before breastfeeding babies and small children. In Table 5.2 it can be seen that several countries include advice on alcohol and breastfeeding in their FBDGs.

- ***Young children, adolescents and elderly people***

Some countries have prohibited alcohol consumption by young children and adolescents. The ages mentioned being 15, 16, or 18-21 (see below), while other, have developed guidelines for sensible drinking which include statements like, "Middle-aged or elderly men and postmenopausal women who drink infrequently or not at all, may wish to consider the possibility that light drinking may benefit their health" (ICAP, 2001; WHO (CINDI), 2000).

- ***Minimum age***

Different countries have different minimum age limits for alcohol consumption. The average age allowed in most countries is 18 years and a few countries (namely, Solomon Islands, Sri Lanka and the United States) recommend 21 years whilst 16 years olds are allowed to drink alcohol in other countries (ICAP, 1998; 2002).

- ***People operating machinery***

The following countries: Italy, Luxembourg, Netherlands, Norway, Spain, Switzerland and Nigeria, include a separate clause within their laws, prohibiting drivers and machinery operators from drinking to avoid accidents and injuries.

- ***Measures of alcohol***

The 'amount' of alcohol contained in alcoholic beverages varies considerably and is referred to as the 'strength' of the drink, which, by law in the European Union (EU), should be expressed as the percentage of alcohol by volume (ABV). Drinks containing alcohol are also ascribed a value of 'units', which relate to the amount of alcohol they contain. A unit of alcohol equates to 8 g or 10 ml of pure alcohol.

- ***Patterns of alcohol drinking around the world***

There is a difference in the definitions of a standard drink's/beverage's size or unit allowed by the various countries for daily consumption, which accounts for differentiation in defining moderate drinking.

Generally, according to Table 5.2 most countries have relatively similar recommendations when taking into account the standard drink unit used, the most common recommendation being a limit of 24 g/day of alcohol for men and 20 g/day for women. According to WHO (1999), the highest recommendation originates from the Basque region of Spain, namely not to exceed more than 70 g/day for men and women. The alcohol content of the Japanese 'standard drink' (also referred to as a unit) is the highest recorded, being over double the amount used for a unit in the UK (19.75 g and 8 g, respectively). However, when comparing average consumption of alcohol (litres of alcohol per adult per annum), it is evident that Japan has a lower alcohol consumption than the UK (the equivalent of 6 L of absolute alcohol consumption compared with an average of 9 L in the UK) (WHO, 1999). One reason why the Japanese have a lower alcohol intake could be the higher prevalence of alcohol flushing responses, known to be particularly prevalent in those of East Asian descent, due to a genetic polymorphism. Symptoms, which include facial flushing, palpitations and drowsiness, are believed to discourage alcohol intake among those who suffer from the condition (Vines, 1999; Yokoyama *et al.,* 2003).

Patterns of drinking obtained from Rehm *et al.* (2004) recorded Moldova Republic as having one the highest levels of alcohol consumption (24.9L of pure alcohol per adult) followed by Lithuania, Latvia, Slovakia as well as some western countries such as Ireland. This differed with the lowest levels of alcohol consumption (6-10L) recorded in Malta and finally by countries that engaged in the Mediterranean drinking style, such as Italy. All these countries have FBDGs with different units of average volume alcohol recommendations.

Overall, Europe has the highest alcohol consumption worldwide, with rates increasing year on year, which is mainly associated with the increased alcohol consumption among the younger European population (Health Promotion Agency, 2001).

People from countries in the Mediterranean region tend to drink more wine-based beverages (wine and fruit brandy), in comparison with those from countries in the north of Europe, that tend to drink more beer-based alcoholic drinks (Popova *et al.* 2007; Sieri *et al.*, 2002). It has been suggested that this may be one of the reasons

that CHD is less common in these areas, a phenomenon referred to as the 'French paradox'. Turkey and Israel have considerably lower intakes than any other European country, which could be due to religious and cultural practices that prohibit alcohol (Neumark *et al.*, 2001). The highest per capita consumption is recorded for Luxembourg, but it is accepted that a significant proportion of alcohol bought in Luxembourg is for consumption by visitors from outside the country (Rehm *et al.*, 2001).

Uganda has been ranked number one out of 185 countries with the highest level of alcohol consumption in the world (with a per capita consumption of 19.47l per adult) followed by some European countries (Room *et al.*, 2004; WHO, 2004b; Popova *et al.*, 2007). Although Uganda is the global leader in alcohol consumption, it is also among the poorest countries (WHO, 2004b). This is in contrast to the general trend worldwide: 'the higher a nation's per capita GDP, the higher its capita alcohol consumption'. The alcohol-related mortality is often highest among the poorest people in a society (Mäkelä, 1999a). Alcohol is often a significant part of family expenditure: Romanians spent an average of 11% of family income on alcohol in 1991, Zimbabwean households averaged 7%. However, national averages conceal the impact on families of drinkers: families with frequent-drinking husbands in Delhi spent 24% of family income on alcohol, compared to 2% in other families. Surveys among the urban poor in Sri Lanka found that 30% of families used alcohol and spent more than 30% of their income on it.

Most countries like Mauritania (ranked 179 with 0.01 per capita) and Saudi Arabia have majority Muslim populations, and thus have no problem with alcohol consumption because of the restrictive religious prohibitive laws.

- ***Muslim countries***

The United Arab Emirates does not have any official guidelines pertaining to alcohol consumption. Alcohol is available in hotels to guests and visitors. Expatriate residents must possess a liquor permit, available to non-Muslims. Retail outlets sell only to permit holders for personal consumption. Providing alcohol to citizens of the United Arab Emirates is forbidden.

- ***Alcohol warning labels***

Health warning labels on alcoholic beverages were motivated by the increasing social cost of alcohol abuse enumerated by the National Institute for Alcohol Abuse and Alcoholism (NIAAA) (Stockley, 2001) in the USA. The ICAP (1997) identified nine countries that have mandated alcohol warning labels. More countries were later found to have passed laws requiring some alcohol warning labels. Sixteen countries: Argentina, Brazil, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, India, Mexico, Portugal, South Korea, Taiwan, Thailand, United States, Venezuela and Zimbabwe, have legislated and implemented health warning labels on alcoholic beverages (Stockwell, 2006). Others such as South Africa, Spain, Ireland, Australia and France are at various stages in the process of considering their introduction. These labels refer mainly to heavy risky consumption generally harming health.

The intention of alcohol warning labels on beverage containers is to assist the population to follow national drinking guidelines for health and road safety. Several countries have warning labels. The different groups of people like Cancer Societies, suggest stronger warning; for example,; "Alcohol can increase the risk of getting cancer including breast cancer and liver cancer".

The detrimental effects of alcohol abuse on health and socio-economic factors are well known. Although the law prohibits young adolescents from buying and drinking alcohol, binge drinking among the youth is recognised as the normative pattern for consumption (Dept. of Trade and Industry, 1997).

5.7. Conclusions and recommendations

The analysis of the data showed that mean alcohol intakes of South Africans is high. The guidelines to drink sensibly, although not yet scientifically tested, is not associated with low intakes. In fact, experience shows that when explaining the alcohol guideline to South African consumers, the men often interpret the alcoholic guideline as "a license" to drink (personal communication: Prof. H. H. Vorster, Potchefstroom, July 2009). This fact argues for a definite recommendation "not to drink alcohol".

Furthermore, alcohol intake is known to be associated with unsafe sexual practices and violence (Shisana & Simbayi, 2002; Morojele *et al.*, 2006). South Africa is a country with high HIV/AIDS prevalence and crime rate. The harms resulting from alcohol misuse in South Africa are at unacceptable levels and action to reduce them is overdue.

These facts argue for a recommendation not to drink.

The FBDGs are good vehicles for providing specific recommendations to the general population about alcohol consumption. The evidence shows that 24 g/day for men and 20 g/day of women will be associated with beneficial effects and that FBDG could be an effective means through which this message can be disseminated to the population if an alcohol recommendation is made. The analysis and discussion suggest that the SA FBDGs should contain a message advising people that it is better not to drink alcohol.

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CHAPTER 6:

Relationships of alcohol intake with biological health outcomes in an African population in transition: The THUSA study

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[a] ***Gopane RE,*** MSc
[b] ***Pisa PT,*** PhD
[b] ***Vorster HH,*** DSc
[b] ***Kruger A,*** PhD
[c] ***Margetts BM,*** PhD

[a] Department of Biological Sciences, North-West University, Mafikeng Campus, Mmabatho 2735, South Africa
[b] Centre of Excellence for Nutrition, North-West University, Potchefstroom 2520, South Africa
[c] Institute of Human Nutrition, University of Southampton, Southampton, UK

Correspondence to: Dr HH Vorster, e-mail: este.vorster@nwu.ac.za

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Abstract

Objective: Because present recommendations on alcohol intake are based mainly on evidence of beneficial effects in populations of developed countries, this study examines biological effects of alcohol consumption in an African population in transition to assess whether these recommendations are also valid for Africans.

Design: A cross-sectional, comparative, population-based study, done between 1996 and 1998.

Setting: Thirty-seven randomly selected sites in the North West Province of South Africa, representing both rural and urban areas.

Subjects: A total of 1 854 apparently healthy men and women older than 15 years volunteered to participate. Complete data of **1757** participants were available for analysis. Pregnant and lactating women as well as subjects taking any form of

chronic medication, those with oral temperatures above 37°C and those who were inebriated were excluded.

Outcome measures: A validated, quantitative food frequency questionnaire was used to measure dietary intake, including alcoholic beverages, expressed as absolute alcohol in grams per day. Anthropometric measurements and blood pressure were taken in triplicate using standardised equipment and procedures. Fasting blood samples were used to determine biochemical variables related to nutritional status and health. Serum gamma glutamyl transferase was used to examine the reliability of reported alcohol intake. The SPSS package was used to relate alcohol intake to blood pressure and biochemical variables, controlling for age, body mass index and blood glucose. Data from men and women, as well as drinkers and non-drinkers, were analysed separately and compared.

Results: In total, 61.5% of the men and 25.2% of the women reported that they consumed alcoholic beverages. The mean alcohol intake of men (30.2 +/- 47.8 g/day) exceeded the recommend value of 21 g/day. The women had a mean intake of 11.4 +/- 18.8 g/day, falling within the 12 to 15 g/day recommendation. Older drinkers (> 40 years) and those infected with HIV drank more. The level of urbanisation had little effect on amounts consumed. Drinkers had significantly higher HDL cholesterol (HDL-c), serum triglycerides, blood pressure and iron status variables than non-drinkers. These effects represent some beneficial but mostly detrimental consequences of alcohol consumption. When serum ferritin was used to classify subjects into those in negative iron balance (< 12 µg/L), 'normal' iron balance (12–150 µg/L) and positive iron balance (> 150 µg/L), it became evident that alcohol intake almost doubled the proportion of subjects in positive iron balance (in men from 25 to 46%; in women from 11 to 23%).

Conclusion: Although the beneficial effect of alcohol consumption on HDL-C was seen in this population, the effects on iron status and balance are of concern and should be researched in more detail.

Introduction:

The food-based dietary guidelines of many countries,[1] including South Africa,[2] recommend to the public that if alcohol is consumed, it should be in moderation, limited or consumed sensibly.[1,2] In those guidelines that specify quantities, sensible or moderate consumption is usually not more than two drinks for men and one drink for women per day, a drink being equal to about 15 g of pure alcohol. This recommendation is based on the reality that there will always be alcohol consumers in any population and that moderate, limited or sensible consumption has been proven to have specific health benefits. The South African Food-Based Dietary Guideline, "If you drink alcohol, drink sensibly", is accompanied by an excellent support paper[2] that provides the evidence for both positive and negative social and physical health effects of alcohol consumption. This paper[2] and others[3] describe the patterns of alcohol consumption in South Africa, but the evidence of the physical health benefits of moderate consumption mainly comes from studies in other countries because of a lack of South African data on possible beneficial effects. In addition to the well-known cardio-protective effects of moderate consumption, primarily mediated through increased HDL cholesterol (HDL-c) and haemostasis,[2] there are studies that claim benefits on iron (Fe) status.[4,5]

A recent publication[4] of the Dikgale study in the Limpopo Province of South Africa concluded that "traditional beer consumption seemed to prevent iron deficiency in those at risk of developing such a deficiency, but appeared to precipitate iron overload in those at risk of developing iron overload". This potential 'beneficial' effect of alcohol consumption on serum ferritin (S-Ft) levels and iron status has also been observed in other African,[5] elderly,[6,7] Danish[8] and Australian populations.[9] However, the relationship between alcohol consumption and ferritin (Ft) levels is also a known consequence of liver damage in chronic alcoholics.[10,11] The mechanisms through which these effects are mediated are unclear.[12–14] In this study we therefore analysed the THUSA data to examine the relationships between alcohol consumption and both 'positive' and 'negative' biological outcomes in an African population in transition[15] to gain more information to either support or warn about the present alcohol guideline[2] to South African consumers. The term "transition" is used to describe a population that is migrating from rural to urban areas, and in the process is exposed to modern lifestyles and changing food environments, with resultant changes in diets.

Methods

Study design, subject selection and organisational procedures

The THUSA study (***T***ransition and ***H***ealth during ***U***rbanisation of **S**outh **A**fricans) was conducted from 1996 to 1998 in the North West Province of South Africa.[15] It was a cross-sectional comparative study in which a community-based sample of 1854 apparently healthy African volunteers (15 years and older) were recruited from 37 randomly selected sites, using a statistical model that ensured a representative sample from five levels of urbanisation: deep rural, commercial farms, informal settlements, 'middle class' urban and 'upper class' urban.[15] Pregnant and lactating women, individuals taking chronic medication, those with oral temperatures above 37°C and inebriated volunteers were excluded. Permission to conduct the study in specific areas with advice on recruitment procedures, was obtained from the North West Department of Health, tribal chiefs, community leaders, headmasters of high schools, employees and City Council mayors. The study was approved by the Ethics Committee of North-West University (Ethics number: 4M5-95) and all participating subjects signed an informed consent form. Subjects fasted (10–12 hours) for the baseline blood sample and other measurements. They received lunch after completion of the glucose tolerance test. All subjects received feedback regarding their blood pressure, fasting glucose levels and haemoglobin values. Where necessary, subjects were referred to their nearest health facility for further diagnosis and treatment. Subjects' travelling expenses were paid. Of the 1 854 participants, complete data for 1 757 were available for analysis.

Questionnaires

The questionnaires used were designed based on or adapted from available and appropriate questionnaires for this study population, and were validated with appropriate methods.[15,16] Questionnaires were issued during individual interviews conducted by the researchers and specially trained African field workers in the language of the subjects' choice. The questionnaires were available in Setswana, English or Afrikaans. The fieldworkers were trained to record dietary intake using a quantitative food frequency questionnaire (QFFQ) during individual interviews with the subjects. As described by MacIntyre,[16] pictures of a variety of foods were used to quantify portion sizes.

The demographic, health and lifestyle questionnaire included questions on type of housing, access to electricity, water source, sanitation, personal and household income, health history (also of close family members), number and ages of people living in the house, ownership of property, education level, and smoking and drinking habits. As mentioned above, dietary intake was measured with a QFFQ developed after a pilot study in which all foods consumed by this population were assessed by comparisons with weighed records. Nutrient intakes were analysed by means of the Medical Research Council (MRC) programme based on the South African Food Composition Tables,[17] including grams of alcohol consumed per day.

Anthropometric measurements

An anthropometrist and specially trained postgraduate students (trained by a level 1 anthropometrist) measured height (stature), weight, seven skinfold thicknesses and body circumferences of subjects in their underwear with calibrated instruments (Precision Health Scale, A & D Company, Japan; Invicta Stadiometer, IP 1465, UK; Holtain® unstretchable metal tape; John Bull® callipers). Skinfold measurements were taken in triplicate.

Clinical examinations

Two registered nursing sisters specially trained to recognise symptoms and signs of undernutrition examined the subjects. Oral temperatures were taken and blood pressure recorded, also in triplicate using a sphygmomanometer (Tycos®) with adjustable cuffs of different sizes.

Glucose tolerance test

After a fasting blood sample was taken, a two-hour glucose tolerance test (GTT) commenced during which subjects took a 75 g glucose load (Alpha® glucose powder, Allied Pharmaceuticals) dissolved in 250 ml water. During blood collection, 5 ml of venous blood samples were collected at 15, 30, 60, 90 and 120 minutes after the glucose load in fluorodised tubes. Blood samples were allowed to clot, immediately centrifuged, aliqoutted into two Eppendorff tubes, and stored as described in the next paragraph.

Blood, serum, plasma, urine and cell samples

Blood was drawn from the *vena cephalica* using a sterile butterfly infusion set (Johnson & Johnson, 21 G, 19 mm) and syringes. For preparation of serum, 5 ml blood was allowed to clot in glass tubes at room temperature, centrifuged at 3 000 rpm for 15 minutes (Universal 16R^{TM}, Hettich, with cooling facilities), and transferred into 30 x 1 ml Eppendorff tubes. Citrated blood was prepared by drawing 4.5 ml blood into a syringe containing 0.5 ml 1 mol/L citrate (pH 4.5–4.8). These samples were centrifuged for 10 minutes at 3 000 rpm in plastic siliconised tubes and the plasma stored in 5 x 1 ml Eppendorff tubes. Haematocrit (centrifuge method) and haemoglobin levels (Boehringer Mannheim) were measured in the field on unclotted blood. All serum, plasma and separated blood cells samples were immediately stored at -18 °C to -20 °C in the field for two to four days and afterwards at -84 °C in the laboratory.

Biochemical analyses

Serum proteins, minerals, electrolytes, glucose, lipids and enzymes were determined with the DAX system (discrete analyser Technicon DAX 48) in the Department of Chemical Pathology, University of Pretoria. Serum vitamin A and E as well as iron, ferritin, iron binding capacity and transferrin were determined in the MRC laboratory of the National Research Programme for Nutrition Intervention at Tygerberg, using immunological, colorimetric and high-performance liquid chromatography methods. Fibrinogen was measured in citrated plasma with the method of Clauss using the AC-L200 (Milan, Italy) system and the international fibrinogen standard (National Institute for Biological Standards and control [code 89/644], Hertfordshire, UK).

Statistical analyses

Data were analysed by using the Statistical Package for Social Sciences (SPSS version 16). Means, medians, standard deviations, standard errors and 95% confidence intervals were calculated. Data that were not normally distributed were logarithmically transformed and non-parametric tests were used to test for significant differences between groups and effects of urbanisation. Univariate analysis of variance (ANOVA), the post hoc test of least significant differences (LSD), multivariate regression analysis, stepwise regression methods and Spearman rank-order correlations with adjustments for confounding factors were used to examine the

influence of alcohol consumption on biological (health) variables. For this study, drinkers and non-drinkers and men and women were analysed separately. To assess the relationship between alcohol and serum ferritin, men and women were grouped into those with negative iron balance (Group 1: serum ferritin below 12 µg/L [according to Kasdan,[18] it can be S-Ft < 25 µg/L]), 'normal' iron balance (Group 2: serum ferritin between 12 and 150 µg/L [according to Kasdan,[18] it can be S-Ft 100 +/- 60 µg/L]) and positive iron balance (Group 3: serum ferritin above 150 µg/L; above 150 µg/L may indicate an Fe overload).[18] These cut-off points were used as they are the clinical cut-off points recommended by a standard dietetic practice.[18]

Data collection for the THUSA study was done in 1996 and 1998. To test whether the two sets of data could be combined, the total reported energy intake of women in the 1996 and 1998 data sets were compared. The mean intake of the 1996 group was 7 975 kJ and of the 1998 group 7 997 kJ, so the two sets of data were combined.

Results

The mean daily alcohol consumption of the THUSA participants are shown in Table I, while the mean intake of subjects in different levels of urbanisation are shown in Table II. Proportionally, more men than women consumed alcohol (62 vs 25% respectively). The mean intake of men was more than double that of women (30.2 vs 11.4 g/day respectively). Men and women older than 40 years had a higher mean intake than those younger than 40 years.

Table I: Reported mean daily alcohol consumption of the THUSA participants

Subject group	n (%)	Mean (g/day)*	SD
Men: drinkers	456 (61.5)	30.2	47.8
Men: non-drinkers	286 (38.5)	-	-
Women: drinkers	256 (25.2)	11.4	18.8
Women: non-drinkers	759 (74.8)	-	-
Men: drinkers < 40 years	255 (55.9)	25.6	40.7
≥ 40 years	201 (44.1)	36.0	55.1
Women: drinkers < 40 years	134 (52.3)	10.8	20.7
≥ 40 years	122 (47.7)	12.0	16.5

* Grams of absolute alcohol calculated from reported intake of alcoholic beverages using the South African Food Composition Tables[17]
SD = standard deviation

Men from the urban middle class level (Table II) constituted the highest proportion of drinkers (73%) and also had the highest mean intake of alcohol (33.7 g/day). Women living on farms had the highest mean intake (15.2 g/day) but a larger proportion of women in informal housing areas reported that they consumed alcoholic beverages (35%).

Table II: Mean daily alcohol intake of male and female drinkers at different levels of urbanization

Subject group	N	%*	Mean (g/day)	SD
Men: drinkers (all ages)				
Rural	100	52	31.5	47.7
Farms	58	54	20.5	21.1
Informal settlements	88	69	30.8	49.8
Urban middle class	168	73	33.7	56.9
Urban upper class	42	49	25.0	24.6
Total	456	61	30.2	47.8
Women: drinkers (all ages)				
Rural	55	19	12.1	14.2
Farms	43	29	15.2	19.3
Informal settlements	61	35	10.9	20.8
Urban middle class	75	26	11.6	21.6
Urban upper class	22	21	2.8	6.2
Total	256	25	11.4	18.8

* Percentage of drinkers of total participants in each urbanisation group
SD = standard deviation

Table III shows that HIV-infected subjects had a slightly higher mean intake of alcohol than non-infected drinkers. The percentage of drinkers who were HIV infected was similar in men and women (13.5 and 13.7% respectively). It is not shown in Table III, but in the total sample of drinkers and non-drinkers, 13% of the men and 11.6% of the women were infected.[15]

Table III: Mean daily alcohol consumption of HIV-infected and non-infected subjects who reported that they drank

Subject group	n	%*	Mean (g/day)	SD
Men: HIV-infected	62	13.5	36.2	67.7
Non-infected	396	86.5	29.1	43.8
Women: HIV-infected	35	13.7	13.0	15.3
Non-infected	221	86.3	11.1	19.3

* Percentage of drinkers
SD = standard deviation

Table IV compares the means of variables suspected of being influenced by alcohol consumption between drinkers and non-drinkers. The mean age of the male drinkers was significantly higher than that of the non-drinkers, and therefore all correlations were adjusted for age. In both men and women serum HDL-C, but also serum triglycerides, was significantly higher in drinkers. Blood pressure, serum iron (but not haemoglobin) as well as serum ferritin levels were significantly higher in male and female drinkers. Total iron binding capacity (TIBC) differed significantly in drinking and non-drinking men as did transferrin saturation (TF-SAT) in both men and women. The mean reported dietary intake of iron of drinkers and non-drinkers did not differ significantly.

Table IV: Comparison of biochemical, physiological and dietary data of drinkers and non-drinkers

Variable	Men				Women			
	Drinkers		Non-drinkers		Drinkers		Non-drinkers	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (years)	39.2*	14.5	33.9	16.2	39.2	13.1	37.3	14.5
Body mass index (BMI) (kg/m^2)	21.0	3.5	21.2	4.1	26.8	7.2	27.0	6.7
Total serum cholesterol (mmol/L)	4.04	1.02	3.91	0.94	4.24	1.00	4.24	1.11
HDL-c (mmol/L)	1.30*	0.44	1.07	0.30	1.23#	0.37	1.12	0.30
Serum triglycerides (mmol/L)	1.24*	0.88	1.10	0.61	1.40#	1.01	1.09	0.58
Blood pressure (mmHg)								
Systolic	128*	17	123	15	132#	25	126	20
Diastolic	78*	12	75	11	82#	15	77	13
Haemoglobin (g/dL)	13.5	2.2	13.5	2.0	12.4	2.1	12.1	2.1
Serum iron (mmol/L)	20.4*	9.1	16.5	7.4	16.6#	7.8	14.8	7.7
Serum TIBC (mmol/L)	64.1*	11.6	66.4	15.4	69.2	12.2	69.4	14.3
Transferrin saturation (%)	32.4*	14.6	26.0	13.0	24.8#	12.4	22.0	12.0
Serum ferritin (µg/L)	243*	345	141	252	115#	176	74	145
Dietary intake of iron (mg)	9.3	4.4	9.0	4.4	8.9	4.2	8.4	4.1

* Significant difference between male drinkers and non-drinkers (ANOVA; $p \leq 0.02$)
# Significant difference between female drinkers and non-drinkers (ANOVA; $p \leq 0.02$)
SD = standard deviation

Table V shows that when controlling for the factors known to influence gamma glutamyl transferase (GGT), namely age, BMI and fasting blood glucose, the correlation between GGT and reported alcohol intake in men was not significant. In women, the correlation was highly significant ($r = + 0.233$; $p = 0.0001$). The same table shows that when controlling for age and BMI, factors known to influence HDL-c had a significant positive correlation with alcohol consumption in both men and women. In women there was an even higher correlation with serum triglycerides and also a significant correlation with serum total cholesterol. The correlation between alcohol consumption and blood pressure disappeared in both men and women when controlling for age and BMI. The correlations between alcohol consumption and iron status variables are also shown in Table V, and were significant in men but not in women, except for serum ferritin. There was a significant correlation between alcohol

consumption and ferritin in women only. In men, haemoglobin, serum iron and transferrin saturation had low but significant correlations with alcohol intake.

Table V: Significant correlations between reported alcohol intake and other variables* (drinkers only)

Variable	Men		Women	
	R	p	R	p
Serum GGT#	-	NS	0.233	0.0001
Serum total cholesterol	-	NS	0.145	0.029
HDL-c	0.141	0.005	0.168	0.011
Triglycerides	-	NS	0.223	0.001
Haemoglobin (g/dL)	0.112	0.026		NS
Serum iron	0.110	0.030		NS
% saturation	0.102	0.044		NS
Ferritin		NS	0.152	0.021

* Controlled for age and BMI
# Controlled for age, BMI and fasting blood glucose
Significant difference when $p < 0.05$
r = correlation coefficient (Spearman rank order)

Table VI compares the mean values of iron status variables in male drinkers and non-drinkers divided into three groups of 'iron balance'. For this purpose, serum ferritins of 12 µg/L and 150 µg/L were used to distinguish between those in negative (Group 1) and positive (Group 3) balance.[18] As expected, the mean ages of those in positive balance were higher than those in normal or negative balance because of the known influence of age (significant in the drinkers).

Table VI: Comparison of low, normal and high ferritin groups of male drinkers and non-drinkers

Variable		Drinkers			Non-drinkers		
		1	2	3	1	2	3
Number		7	229	203	16	199	72
Proportion (%)		2	52	46	6	69	25
Age (years)	Mean	22.6	34.0	45.8#	25.8	31.0	44.4
	SD	6.4	13.3	13.4	14.6	16.0	12.3
Alcohol intake (g/day)	Mean	6.6	26.8	34.8			
	SD	7.0	44.1	52.3			
Serum ferritin (µg/L)	Mean	6	75	440#	6	64	384•
	SD	3	37	429	3	38	415
Serum iron (µg/L)	Mean	12.8	19.8	21.3	9.6	16.6	17.6•
	SD	5.3	8.9	9.3	10.2	6.7	7.6
Haemoglobin (g/dL)	Mean	12.8	13.7	13.3	11.5	13.6	13.4•
	SD	1.4	2.4	1.9	2.5	1.9	2.0

Group 1: Serum ferritin levels below 12 µg/L
Group 2: Serum ferritin levels between 12 and 150 µg/L
Group 3: Serum ferritin levels above 150 µg/L
Significant differences within the drinkers groups (ANOVA; $p \leq 0.001$)
• Significant differences within the non-drinkers groups (ANOVA; $p \leq 0.001$)
SD = standard deviation

The mean alcohol intake of the male drinkers in negative balance (Group 1) was 6.6 g/day, compared to 26.8 g/day of those in balance (Group 2) and the 34.8 g/day of those in positive balance (Group 3). These striking differences were, however, only significant on a 10% level ($p \leq 0.094$). In the male drinkers, the significant differences between the three groups of serum iron (S-Fe) and blood haemoglobin (Hb) evident in the non-drinkers were not observed. In the non-drinkers, 6% of the men were, according to criteria used here, in negative iron balance and 25% in positive balance (Table VI). In the drinkers, only 2% were in negative balance but 46% in positive balance.

Table VII shows similar data for women, with the difference that in female drinkers the lowest mean alcohol intake was observed in Group 2 (7.7 +/- 11.7 g/day, thought to be in iron balance (S-Ft levels between 12 and 150 µg/L). Significant differences between groups for serum iron and blood haemoglobin were observed in both

drinkers and non-drinkers. In female drinkers the proportion in negative balance was 14% and in positive balance 23%, compared to the 17 and 11% of non-drinkers.

Table VII: Comparison of low, normal and high ferritin groups of female drinkers and non-drinkers

Variable		Drinkers			Non-drinkers		
		1	2	3	1	2	3
Number		33	154	58	124	530	80
Proportion (percentage)		14	63	23	17	72	11
		28.4	38.5	46.6#	31.2	37.1	48.3
Age (years)	Mean	10.0	12.6	11.8	12.2	13.8	15.9
	SD						
		12.3	7.7	20.1#			
Alcohol intake	Mean	20.4	11.7	28.8			
(g/day)	SD						
		6	6.4	384#	6	52	326•
Serum ferritin	Mean	3	3.8	415	3	34	335
(µg/L)	SD	12.4	16.8	18.6#	9.8	15.7	16.6•
Serum iron	Mean	8.1	6.9	8.8	7.1	7.2	8.5
(µg/L)	SD	11.3	12.5	12.6#	11.0	12.3	12.3•
Haemoglobin	Mean	2.1	2.1	2.0	2.1	1.9	2.6
(g/dL)	SD						

Group 1: Serum ferritin levels below 12 µg/L
Group 2: Serum ferritin levels between 12 and 150 µg/L
Group 3: Serum ferritin levels above 150 µg/L
Significant differences within the drinkers groups (ANOVA; $p \leq 0.001$)
• Significant differences within the non-drinkers groups (ANOVA; $p \leq 0.001$)
SD = standard deviation

Discussion

Limitation of reported intake

The first issue to address is the reliability of the reported alcohol intake, because how much and what one drinks may be a sensitive question. Intake was assessed in two questionnaires: the demographic, health and lifestyle questionnaire[15] to get an indication of drinking patterns and the validated QFFQ[16] to measure habitual intake of specific alcoholic beverages. The latter was used to calculate absolute alcohol intake per day. GGT is often used in epidemiological studies[19] as a proxy for alcohol

intake. This liver enzyme detected in serum is, however, non-specific and may also be influenced by other factors, such as diabetes. Although the population sample was recruited as apparently healthy, some subjects were diagnosed with diabetes[15] and therefore blood glucose as well as age and BMI were controlled for to determine the relationship between reported alcohol intake and GGT. In women this relationship was highly significant but not in men, suggesting that women may have been more accurate and 'honest' in their estimates of alcohol consumed. Nonetheless, the expected significant correlations between reported intake and HDL-c known to be influenced by alcohol consumption[2] were observed in this study, as shown in Table V.

Type of alcohol consumed

The results are not shown here, but MacIntyre[16] compared the 10 food items consumed in the largest amounts per person per day across levels of urbanisation for this population. Sorghum beer was in fourth place on the food list in rural women and those living on farms; the second place in those living in informal housing areas and the eighth place in the urban middle class. No alcoholic beverage fell into the first 10 foods consumed by upper class urban women. As for men, sorghum beer was the third largest food consumed by rural men and those living on farms and in informal housing areas. Commercial beer had the second place in the urban middle class and first place in the urban upper class men.

Amount of alcohol consumed

Most European, UK and North American countries' guidelines recommend that daily alcohol intake should not exceed 5% of total energy intake, or 20 g for men and 15 g for women.[1,6,20] The male drinkers in the THUSA sample reported a higher intake (a mean of 30.2 g/day) while the women drinkers, with a mean intake of 11.4 g/day, complied with this general guideline. However, the standard deviations were very large (47.8 and 18.8 respectively), illustrating a wide variety in intake with many men and women having much higher intake. Urbanisation had a small effect on amounts of alcohol consumed, but a large effect on type of alcoholic beverage taken by men, with commercial beer replacing sorghum beer in urban areas. Almost two-thirds of the men reported an intake (61.5%) at mean levels above the recommended intake, and therefore it seems reasonable to conclude that alcohol may be a problem in the male population of this sample. In contrast, only 25% of the women reported an

alcohol intake, and with mean levels generally in the recommended levels, the same conclusion cannot be drawn for women from the amounts consumed. Therefore, a closer look at biological effects of alcohol consumption is necessary.

Biological effects of alcohol consumption

The beneficial effects of moderate alcohol consumption are related to increases in HDL-c, modified platelet clotting and fibrinolytic activities[2,21] as well as a lower risk for type 2 diabetes.[22] 'Moderate' refers to the recommended amounts as given in previous paragraph: less than 5% energy, or 20 g for men and 15 g for women daily. In this study platelet and fibrinolytic functions were not measured. However, fibrinogen levels did not differ between drinkers and non-drinkers and the negative correlation of fibrinogen with alcohol intake in men ($r = -0.026$) was not significant ($p = 0.513$). The positive effect on HDL-c was significant in both male and female drinkers ($p \leq 0.005$) but was accompanied by increased triglyceride levels in women, as shown in Table IV. Mean levels of all serum lipids were, however, within normal ranges for both men and women; the cut-off points for being normal were values < 5 and < 1.7 mmol/L for total cholesterol and triglycerides respectively. For HDL-c, values ≥ 1 for men and ≥ 1.2 mmol/L for women were used.[23]

A potential detrimental effect of alcohol intake on blood pressure disappeared when controlling for age and BMI. It seems, therefore, that in balance, effects of alcohol on serum lipids and blood pressure (both cardiovascular risk factors) in this sample were small. However, the effects on iron balance are of concern. Two studies, one in a rural population in Limpopo[4] and one from Tanzania,[5] interpreted the effects of alcohol on increases in serum ferritin as an improvement of iron status. The possible mechanisms offered by the authors of these papers to explain this effect are a contribution of micronutrients (including iron) by local, home-brewed beverages[4,5] and an increased absorption of iron because of effects on gastric hydrochloric acid secretion and iron solubility.[5]

Ferritin is an iron-apoferritin complex, the major form of iron in tissue.[18] It sequesters iron in a readily available form. Serum ferritin is proportional to intracellular ferritin and therefore under normal circumstances in equilibrium with body stores.[18] Serum ferritin levels greater than 150 µg/L reflect stage 1 of positive iron balance. It is known that iron overload may be a problem in African adults,[25] in the aged[7,11] and

because of excessive alcohol consumption.[11] Therefore, it is necessary to evaluate and weigh a potentially positive effect of alcohol on iron status in a population known to be iron deficient[25] against a possible detrimental effect on iron overload or positive iron balance.

Tables VI and VII show that if levels of serum ferritin less than 12 µg/L and more than 150 µg/L are used to classify subjects as being in either negative or positive iron balance, alcohol intake had a dramatic effect on the proportion of subjects in negative and positive balance. In men, 6% of non-drinkers and only 2% of drinkers were in negative balance. In women, the corresponding figures were 17 and 14%. However, the proportion of subjects in positive balance almost doubled: from 25% in non-drinkers to 46% in drinking men and 11 to 23% in women. These changes in the proportion of subjects with increased serum ferritin levels may be interpreted as (i) that alcohol intake increased body iron stores in a substantial number of men and women, or (ii) that alcohol intake disrupted the equilibrium between the body and circulating ferritin levels.

The relationship between alcohol intake and iron status has also been examined in other populations. In an Australian study[26] the effects of alcohol consumption on serum iron, transferrin and ferritin was examined in 3 375 adult twin subjects. The authors concluded that "alcohol intake at low levels increases ferritin and, by inference, body iron stores". This may be either beneficial or harmful, depending on circumstances. In an American study[27] adult participants of the Third National Health and Nutrition Examination Survey who did not consume alcohol (n = 8 839) were compared with participants who consumed ≤ 1 (n = 4 976), > 1 to ≤ 2 (n = 1153) or > 2 (n = 915) alcoholic drinks per day during the preceding months. Compared with non-drinkers the prevalence of all markers of iron overload was significantly elevated among those who consumed more than two alcoholic drinks per day (after adjusting for potential confounders). Consumption of any amount of alcohol was associated with a 40% reduction in the risk of iron deficiency anaemia. These authors concluded that "consumption of up to 2 alcoholic drinks per day seems to be associated with a reduced risk in iron deficiency and iron deficiency anaemia without a concomitant increase in the risk of iron overload. Consumption of more than 2 alcoholic drinks per day is associated with a significant elevation in the risk of iron overload". Both these studies suggest that the effect of alcohol consumption at low levels "may be beneficial" depending on the circumstances – which may be interpreted as in populations with a high prevalence of iron deficiency.

However, before there is evidence that the increased serum ferritin seen in this THUSA population as well as the Australian[26] and American[27] studies on alcohol consumption is indeed reflective of increased body iron stores and not of a disputed equilibrium between body and circulating ferritin, no firm conclusion about the benefit of this effect can be drawn.

It is important that this question regarding either beneficial or harmful effects of alcohol consumption on iron status be addressed. There is an increasing global awareness of the harms associated with drinking alcoholic beverages.[28] If any beneficial effects are used to motivate or justify alcohol consumption, there should be more persuasive evidence that low to moderate consumption is indeed beneficial. More research is needed before this question can be fully answered. Haemochromatosis and its genetic determinants were not measured in the THUSA population, but the above results indicate that alcohol intake may have detrimental effects on iron balance in this adult African population in transition.

Conclusions

It is concluded that apparently healthy men participating in the THUSA study had a mean reported intake of alcohol that exceeded present recommendations of moderate intake, while the mean intake of women was within the upper limit of these recommendations. Subjects who were HIV infected used more alcohol than uninfected subjects. The known beneficial effects of alcohol on HDL-c were apparent, but non-drinkers also had mean HDL-c levels within the recommended range.[23] Alcohol intake was associated with an increased serum ferritin level and more drinkers than non-drinkers were in positive iron balance. It is suggested that this possible detrimental effect of alcohol on iron balance should be examined further in this population.

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CHAPTER 7:

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

7.1. Introduction

This study was part of the larger alcohol study extending over a period of five years that is conducted by the Africa Unit for Transdisciplinary Health Research (AUTHer), in the Faculty of Health Sciences at the North-West University. Data from the "Transition and Health during Urbanization in South Africa" survey (THUSA) were analysed to determine the relationship of alcohol intake with the biological health outcomes in an African population in transition. The THUSA study (Vorster *et al.*, 2005) was undertaken during 1996 and 1998 to compare the prevalence of known risk factors for non-communicable diseases in Africans in the North West Province at different stages of urbanisation and to provide information for the development of preventative strategies.

The rationale to undertake the Alcohol study, of which this thesis represents one of the sub-studies, is that the South African population is experiencing a health transition due to rapid urbanisation. Urban areas provide cheaper and more ready to use high-fat convenience foods, accompanied by high availability of alcohol. This urbanisation and changes in lifestyle could result in high levels of hazardous alcohol use that may cause a decline in the quality of life. South Africa's per capita alcohol consumption merits the dishonor of ranking number 47 among the 147 alcohol consuming countries in the world. Secondly, South Africa, is on score 3 in a pattern of drinking score, qualifying because of high quantities of drinking per occasion, frequency of getting drunk, drinking in public places and not drinking with meals (Gmel *et al.*, 2001; Rehm *et al.*, 2001; Rehm *et al.*, 2003; Rehm *et al.*, 2004), a pattern known as "binge" drinking.

Alcohol is associated with many acute and chronic risks which proved to be more problematic within black South Africans.

The purpose of this chapter is:

- To combine the results from all previous chapters in order to evaluate how appropriate the present (existing) FBDG on alcohol is for the African population;
- To answer the question: will this population be served better by another guideline?
- How should such a guideline be formulated?

7.2. Limitations of the study

The misuse and abuse of alcohol have both biological and societal causes and consequences. It is, therefore, a very wide field to study, stretching over several scientific disciplines. For the purpose of this study, the scope was defined to those aspects which could motivate recommendations for alcohol consumption as part of a set of food-based dietary guidelines for the South African population. The focus was, therefore, on an integration of facts and knowledge from different scientific disciplines that would contribute to a better understanding of the causes and consequences of alcohol misuse and abuse in South Africa, and how this knowledge could be used to formulate an appropriate guideline for alcohol consumption in South Africa. The review of existing drinking patterns and the causes and consequences of irresponsible drinking were therefore, not comprehensive and detailed, but include aspects of knowledge for motivation of a possible new FBDG for alcohol consumption.

Another limitation is the lack of knowledge about the putative beneficial effects of alcohol consumption in blacks South Africans. These beneficial effects are generally used to motivate moderate alcohol consumption. At least one study could demonstrate that these effects were not seen in Afro-Americans (Sempos *et al.,* 2002; Fuchs *et al.*, 2004).

The major limitation in most studies of alcohol consumption is the quality of data regarding alcohol intakes. This is usually self-reported data, and in many instances, part of food frequency questionnaire data (as used in this study for analysis of the THUSA data in Chapter 6). In a population where excessive alcohol consumption is

seen as a "macho" or male accomplishment and where there are taboo's about female drinking, one could expect over-reporting in men and under-reporting in women. Serum levels of gamma glutamyl transferase were used as marker for alcohol consumption in the THUSA study (Chapter 6), but unfortunately this is a non-specific marker which is also influenced by other factors such as diabetes or glucose intolerance. Furthermore, these epidemiological studies often report total intake and little information on frequency of intake at specific times to characterise binge drinking.

7.3. Main findings of this thesis

The salient findings in Chapters 2-6 of this thesis, which could or should inform and motivate a reformulation of the existing FBDG regarding alcohol consumption in South Africa will be briefly summarised:

- In Chapter 2 it was seen that the history of alcohol consumption amongst black South Africans, has not been conducive to responsible, sensible or moderate consumption. Under colonial, and later Apartheid rule, the production of nutritious home-brewed beer from an indigenous plant, sorghum, was almost destroyed. In protest against laws and regulations pertaining to alcohol consumption, black men developed a culture of excessive drinking. This chapter summarised the data showing that urbanization and acculturation are also characterised by increased drinking of African women and that binge drinking amongst African men is a problem. It was also found that there is evidence that alcohol abuse may lead to irresponsible sexual behaviour that contributes to the HIV/AIDS pandemic in South Africa.
- The biological and social harmful effects of alcohol misuse and abuse were further explored in a literature review in Chapter 3. The main findings were that most of these detrimental effects, but especially those on the vascular system, were exacerbated by binge drinking. It was concluded that binge drinking amongst the South African population should be addressed more aggressively to reduce these harmful consequences of alcohol abuse.
- The potential beneficial effects of moderate alcohol consumption were reviewed in Chapter 4, indicating that sensible drinking could contribute to stress relief, creativity and an enjoyable lifestyle. Moderate consumption was

shown to be associated with a protective effect on cardiovascular morbidity and on total mortality, possibly because of beneficial effects on HDL-cholesterol, insulin resistance, decreases in free fatty acids and effects on blood clotting and fibrinolysis. It was pointed out, however, that there was little evidence that these effects are present in the African population.

- Chapters 2 and 3 also showed that possible beneficial effects of alcohol consumption on health were apparent only after the age 40 years in men and 50 years in women. Before that age, the consequences of alcohol consumption are more negative in terms of accidents, diseases directly linked to alcohol (cirrhosis of the liver, mouth and larynx cancers and others), and the risk of alcohol addiction. The literature reported high incidences of mortality and morbidity in South Africa due to accidents, violence, unsafe sexual behaviours and high prevalence of FAS (Parry *et al.*, 2002). South Africa has the highest rate of FAS in the world (Viljoen *et al.,* 2005).

- In Chapter 6, the putative beneficial effects of moderate alcohol consumption were examined in an African population in transition. In the THUSA study beer was the most preferred alcoholic beverage during the urbanisation replacing the traditional homebrew. Both rural and urban men had high intakes, but intakes of urban women were higher than those of rural women. Alcohol intake in the THUSA study was associated with an increased serum ferritin level and more drinkers than non-drinkers were in positive iron balance. The plausible explanations offered are a contribution from micronutrients in traditional home brewed alcoholic beverages (Choma *et al.*, 2007; Malenganisho *et al.*, 2007) and an increased absorption of iron due to alcohol inducing gastric hydrochloric acid secretion which in turn increases iron solubility (Malenganisho *et al.*, 2007). It was speculated (in Chapter 6) that alcohol intake could also have disturbed the serum and liver ferritin balance. Regardless of the mechanism, it was concluded that the shift towards a positive iron balance and possible iron overload because of alcohol consumption in the African population, could not be seen as beneficial. Although more studies are needed to clarify the responsible mechanism, it was concluded that in this population, the harmful effects of alcohol abuse probably overshadowed the beneficial effects observed.

7.4. Should the South African guideline be changed?

Realistic numbers prove that "moderate, sensible daily drinking is a smooth, slippery slope that drinkers may fail to manoeuvre safely". Although awareness of alcohol abuse problems in South Africa has increased of late, the levels of drinking have increased, especially among young Black males (Parry, 2005). Surveys suggest that exceeding guidelines for "sensible" alcohol consumption is widespread, and that the health and social consequences have an adverse impact on quality of lives in South-Africa. This calls for drastic measures like the one taken against smoking. The call for complete abstinence may be overdue.

Chapters 2 to 6 clearly showed that the present guideline: "If you drink alcohol, drink sensibly" is not associated with sensible drinking by many South Africans, especially men. It was also shown that the consequences of alcohol abuse in South African society far outweigh the potential or putative beneficial effects. It seems that the main benefit of an increased HDL-cholesterol is not needed by this population, which already has high HDL-cholesterol levels (Vorster *et al.*, 2005). Possible detrimental effects on iron balance in a population known to be vulnerable to iron overload (Choma *et al.*, 2007; Malenganisho *et al.*, 2007) are of concern.

It could be that the FBDGs are not implemented in a way that they change eating and drinking behaviour. However, it was mentioned in Chapter 5 that the guideline could be interpreted as a "licence to drink". The above facts all argue for a change or reformulation of the present drinking guideline.

7.5. Reformulation of the guideline

There are different options for reformulating the present alcohol guideline in the South African FBDGs. These include:

- Do not include a guideline on alcohol, as 19 of the 75 countries studied did. The argument against this option is that a set of FBDGs, if implemented properly could be a very effective way to reach a population with dietary recommendations (as shown in Chapter 5).
- Change the guideline to "Don't drink"- as a guideline regarding smoking is formulated in some FBDGs which also cover healthy lifestyles. The argument against such a change is that it does not take reality into account. History has

shown that there always will be those in society who drink, and it is really these segments of society that need a guideline on how to drink moderately, sensibly or responsibly. The argument and motivation for such a change could, however, be the devastating consequences of alcohol abuse seen in South African society.

- A third option is to change the present qualitative guideline to a much more explicit quantitative one, giving and motivating quantities and frequency of consumption and indicating when to abstain. Such a guideline could include the following statements:

  It is always better not to drink any alcoholic beverage

  Pregnant and breastfeeding women should not drink at all (because it can/will harm your baby

  People under the age of 18 are not allowed to buy alcohol and should not drink alcohol

  Don't drink and drive

  Don't drink if you are infected with HIV

  If you drink, drink sensibly, moderately and only with meals

  Don't binge drink over weekends or other occasions

  Men should not drink more than 4-5 units per day and women not more than 4-3 units per day, a drink or unit being 8 grams or 10 ml of pure alcohol.

Even if such a guideline is the only quantitative guideline in a set of qualitative FBDGs, it would emphasise the importance of how alcohol should be used by those that choose to drink. The main argument for such a guideline is that it will take reality of drinking into account, at the same time giving information to specific groups about responsible drinking. FBDGs should be implemented by using an appropriate food guide and education material, integrated into other health-promotion programmes in a country (WHO, 2009). Such a reformulated guideline on alcohol consumption should, therefore, be incorporated into all health promotion material and programmes in South Africa.

7.6. Conclusions

7.6.1. General conclusions from the literature review

From the literature reviews in Chapters 2, 3, 4 and 5, the following facts call for the suggestion of the revision of the current drinking guideline:

- There are no health or cardio-protective benefits of alcohol consumption in the young, and probably also not in Africans.
- Drinking patterns, especially drinking to drunkenness, lead to risky sexual behaviours and social consequences.
- Although there are nutritional micronutrients in sorghum and commercial beer, heavy risky drinking results in malnutrition.
- Drinking during pregnancy has resulted in high levels of foetal alcohol syndrome in South Africa.
- Statistics show high prevalence of alcohol-related violence and crime in South Africa.
- Traffic accidents and deaths caused by drinking and driving are well documented.
- The South African drinking population exceeds the guidelines for "sensible" alcohol consumption.

7.6.2. Conclusions from Chapter 6

An analysis of the THUSA data showed that although the increased HDL-cholesterol with alcohol consumption was observed, this population already had high, protective HDL-cholesterol levels. The possible detrimental effects seen on iron balance, motivated a statement that the biological benefits were not significant in the THUSA study and do not warrant nor motivate an alcohol drinking guideline.

7.6.3. Conclusions regarding a new FBDG for alcohol

The analysis of the data showed that mean alcohol intake of South Africans is high. The guideline to drink sensibly, although not yet scientifically tested, is not associated with low intakes. Controlling drinking volume alone is inadequate to control alcohol-related consequences. There is a need to control both the volume of drinking and the frequency to lower the risk of chronic diseases and the risk of acute harm (Bondy, 1999; NHMRC, 2001). The guideline should define a level at which the risk of all-cause mortality increases significantly. The UK and USA drinking guidelines give the upper limits, but drinking at these upper limits of the lower risk levels placed individuals at risk for dependence. Needless to say, nearly all alcoholic persons were initially "responsible, moderate, sensible drinkers".

- Given the evidence of the failure of the present guideline, it was concluded that the present guideline should change. It was further concluded that there are different options, from not making a statement regarding alcohol, to a statement "do not drink," to changing the present qualitative guideline into a much more quantitative, explicit guideline giving advice about quantities and frequency of drinking to specific groups.

Despite the drinking-driving counter measures, and research on alcohol prevention treatment programme, evidence shows that the attempt to minimise harm from drinking and to drink responsibly and sensibly has failed. If research showing the safe limit of drinking could have evoked positive behavioural changes in the society, then many people will be abstaining or living and drinking healthily. The alcohol industry sponsors many community projects like soccer and other sports, but this positive venture is negated by the harmful use discussed above. The study, therefore, suggests that a new guideline of 'do not drink' is appropriate without being prescriptive.

7.6.4. The way forward: recommendations

There is need for the revision of a new drinking guideline which must be accompanied by awareness campaigns and education on the detriments of alcohol

intake. The education campaigns should start at lower schools because several studies reported alcohol consumption and substance abuse in very young adolescents. Research to find the reasons for exceeding the recommended limits in the guidelines should be undertaken. This may explain and help avoid the mistakes made during policies prohibiting alcohol which led to illegal alcohol sales and brewing of beverages with very high alcohol content.

The practical step would be to organise a gathering (workshop) of all stakeholders to get agreement for a reformulated guideline and how it should be worded. The stakeholders should represent the following:

- Academics and especially researchers in the alcohol field
- Departments of Health, Trade and Industry, Economics, Education
- Department of Mental Health and Substance Dependence
- Brewery Industry, and all other industries producing alcoholic beverages
- Psychiatrists, psychologists and social workers
- Nutritionists and dieticians
- Marketing industry
- Policy makers, especially from the mentioned Government Departments
- Rehabilitation Centres
- Religious groups.

Finally, it is recommended that the new, agreed upon FBDG regarding alcohol consumption, should be marketed aggressively, using social marketing strategies to change behaviour. South Africa cannot afford the social and health consequences of alcohol misuse and abuse. The time to intervene is now!

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ADDENDUM 1: Recruitment and informed consent form

THUSA PROJECT : PU FOR CHE

RECRUITMENT AND INFORMED CONSENT FORM

Title of the project: Nutritional and health status of Africans in transition

Name: .....
No.....

Address:
.....

Tel no:.....
.....

Age:
.....
.....

Are you pregnant? .....

Are you lactating? .....

Do you suffer from diabetes? hypertension? Other disease?.....

When did you have your last meal?
.....

or anything but water to drink?
.....

INFORMED CONSENT

I, the undersigned ..... (full names in print), have read the details of the project or, have listened to the oral explanation thereof, and declare that I understand it. I have had the opportunity to discuss relevant aspects with the researcher and declare that I voluntarily participate in the project. I hereby give consent to participate in the project.

.....
Signature of volunteer

Witnesses

.....
.....
.....

Signed at ..... on .....

For subjects under the age of 21, signed consent of a parent or legal guardian is necessary.

1, ... (full names) the parent/legal guardian of the person named above, hereby consent that he/she may participate in the THUSA project.

Signature ..... Date .....

Relationship .....

ADDENDUM 2: Anthropometry form

THUSA PROJECT – SOUTH AFRICA 1998
ANTHROPOMETRY

Subject ID#

Gender (1 = M, 2 = F)

Projection box + constant

		.	

Skinfolds

Triceps			.				.					.			
Subscapular			.				.					.			
Illiac Crest			.				.					.			
Supraspinale			.				.					.			
Abdominal			.				.					.			
Front Thigh			.				.					.			
Medial Calf			.				.					.			

Girths

Arm - Relaxed			.				.					.			
Arm - Fully flexed/Tensed			.				.					.			
Forearm - Maximum			.				.					.			
Waist - Minimum			.				.					.			
Hip (Gluteal) - Maximum			.				.					.			
Thigh - 1cm below gluteal fold			.				.					.			
Thigh - Mid trio-tib lat			.				.					.			
Calf - Maximum			.				.					.			

Breadths

Humerus (cm)			.				.						.		
Wrist (cm)			.				.						.		
Femur (cm)			.				.						.		
Ankle (cm)			.				.						.		

Other

Mass (kg)				.	
Stature - Stretched (cm)				.	

ADDENDUM 3: Demographic questionnaire

Potchefstroomse Universiteit

vir Christelike Hoër Onderwys

Subject number			
Date	D	M	Y
Place			
Interviewer			

Home address _____

_____

_____

_____

Sex		
	Male	1
	Female	2

Age				
Date of birth	D	M	Y	

First Language		
	Tswana	1
	Afr	2
	Eng	3
	Xhosa	4
	Zulu	5
	Other	6

Second Language		
	Tswana	1
	Afr	2
	Eng	3
	Xhosa	4
	Zulu	5
	Other	6

What is your marital status?		
	Never married	1
	Married	2
	Divorced	3
	Widowed	4

Do you suffer from:			
	High blood	Yes	1
		No	2
	Diabetes	Yes	1
		No	2
	CHD	Yes	1
		No	2
	Stroke	Yes	1
		No	2

Does anyone in your family suffer from:			
	High blood	Yes	1
		No	2
	Diabetes	Yes	1
		No	2
	CHD	Yes	1
		No	2
	Stroke	Yes	1
		No	2

Do you take medicine regularly?		
	Yes	1
	No	2
If yes - what do you take?		

Do you snuff?			
		Yes	1
		No	2
Do you smoke?		Yes	1
		No	2
If no - have you smoked regularly before?		Yes	1
		No	2
If yes - what do you smoke?		Cigarettes	1
		Tobacco/pipe	2
		Other	3
If other - describe			
How much do you smoke?	per day		
	per week		
For how long have you been smoking (years)			
Calculate pack years			

What is your highest qualification?		
	None	1
	< St.6	2
	St. 6-8	3
	St. 6-8 + trade	4
	St. 9-10	5
	St. 9-10 + trade	6
	St. 9-10 + academic	7

What is your occupation?	

Do you have a job at the moment?	Yes	1
	No	2

If yes - what kind of job?	

On which days of the week do you work?	Irregular (piece work)	1
	Part time (1-4 days)	2
	Full time (5-6 days)	3

How much money do you earn? Is it between:	R0-100	
	R101-500	
	R501-1000	
	R1000-2000	
	R2000-3000	
	R3000+	

What is the source of this income?	

Do you receive any additional pensions?	Yes	1
	No	2

How much pension do you receive per month?	

Interviewer - *Re-evaluate final income category*	R0-100	1
	R101-500	2
	R501-1000	3
	R1000-2000	4
	R2000-3000	5
	R3000+	6

Who else contributes money to your household? How much?

Yes	1
No	2

_____
_____
_____
_____

Who else contributes other resources eg. food, sharing work/chores to your household? - specify!

Yes	1
No	2

_____
_____
_____
_____

Does any member of your household have the right to use any property as his/her own?	Yes	1
	No	2

What type of property?	

How do you use it?	

Please name the members of your household

Member	Age	Education	Present job

What type of house do you live in?	Traditional	1
	Mokhukhu	2
	Brick house	3
	Other	4
Specify other		

Do you share a toilet with other households?	Yes	1
	No	2

What type of toilet do you have?	Communal	1
	None	2
	Bucket system	3
	Outside longdrop	4
	Outside chemical	5
	Outside water flush	6
	Inside water flush	7

Where do you get your drinking water from?	Fountain, river	1
	Communal tap	2
	Tap on premises	3
	Tap in house	4
	Other	5
If other specify		

Do you have access to electricity inside your house?	Yes	1
	No	2

What type of stove do you have?	None	1
	Coal/wood	2

	Gas or paraffin	3
	Electric	4

What type of fridge do you have?	None	1
	Paraffin	2
	Gas	3
	Electric	4

How long have you been living here? (years)	

Where did you live before coming here?	Rural area	1
	Farm	2
	Squatter camp	3
	Township	4

THUSA Quantitative Food Frequency Questionnaire

Subject ID **Subject Initials**

☐☐ ☐☐☐ ☐☐☐ ☐☐ ☐☐☐

Centre # ***Community #*** ***Household #*** ***Subject # M L***

Today's date: ☐☐☐☐ ☐☐ ☐☐
year *month* *day*

1. Name: _____
_____

2. Not applicable in South Africa

3. National identity # or equivalent _____ ☐
N/A

4. DOB: ☐☐☐☐ ☐☐ ☐☐ **OR** **Age** ☐☐ **years**

5. Sex: ☐ Female ☐ Male

Please think carefully about the food and drink you have consumed during the ***past month*** (four weeks). I will go through a list of foods and drinks with you and I would like you to tell me:

- If you eat the food
- How the food is prepared
- How much of the food you eat at a time
- How many times a day you eat it and if you do not eat it everyday, how many times a week or a month you eat it.

To help you to describe the amount of a food you eat, I will show you pictures of different amounts of the food. Please say which picture is the closest to the amount you eat, or if it is smaller, between the sizes or bigger than the pictures.

There are no right or wrong answers.

Everything you tell me is confidential. Only your subject number appears on the form.

Is there anything you want to ask now?

Are you willing to go on with the questions?

☐

FOOD FREQUENCY QUESTIONNAIRE

INSTRUCTIONS: Circle the subject's answer. Fill in the amount and times eaten in the appropriate columns.

I shall now ask you about the type and the amount of food you have been eating in the last few months. Please tell if you eat the food, how much you eat and how often you eat it. We shall start with maize meal porridge.

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
PORRIDGE AND BREAKFAST CEREALS AND OTHER STARCH								
Maize-meal porridge	Stiff (pap)						3400	
Maize-meal porridge	Soft (slappap)						3399	
Maize-meal porridge	Crumbly (phutu)						3401	
Ting								
Mabella	Stiff						3437	
Mabella	Soft							
Oats							3239	
Other cooked porridge	Type: _____							
Breakfast cereals	Brand name of cereals at home now: _____ _____ _____ _____							

Do you pour milk on your porridge or cereal? Ye 1 No 2

If yes, what type of milk (whole fresh, sour, 1%, fat free, milk blend, etc)

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
If yes, how much milk								
Do you put sugar on your porridge or cereal?		Ye 1		No 2				
If yes, how much sugar							3989	
							3989	
							3989	
Samp	Bought Self ground						3250	
Samp and beans	Give ratio of samp:beans						3402 (1:1)	
Samp and peanuts	Give ratio of samp:peanuts						3250 (samp)	
Rice	White						3247	
	Brown						3315	
	Maize Rice						3250	
Pasta	Macaroni Spaghetti Other specify: _____ _____						3262	
Pizza	Home made: Specify topping _____ _____						3353 (base+ ch)	

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	Bought: Specify topping _____ _____						3353 (base+ ch)	

You are being very helpful. Can I now ask you about meat?

CHICKEN, MEAT, FISH

How many times do you eat meat (beef, mutton, pork, chicken, fish) per week?

_____

Chicken (codes with skin)	Boiled						2926	
	Fried: in batter/crumbs Eg Kentucky						3018	
	Fried: Not coated							
	Bought: Chicken Licken						2925	
	Bought: Nando's							
	Roasted / Grilled						2925	
	Other: _____							

Do you eat chicken skin? Always 1 Sometimes 2 Never 3

Chicken bones stew								
Chicken feet							2997	
Chicken offal								
Red meat	How do you like meat? With fat Fat trimmed							
Red meat	Fried							
	Stewed							
	Mince with tomato and onion						2987	

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	Other:							
Beef Offal	Intestines: boiled nothing added						3003	
	Stewed with vegetables							
	Liver						2920	
	Kidney						2923	
	Other: Specify _____ _____							
Goat meat	Boiled						4281	
	Stewed with vegetables							
	Grilled / Roasted						4281	
What type of vegetables is usually put into meat stews? _____ _____								
Wors / Sausage							2931	
Bacon							2906	
Cold meats	Polony						2919	
	Ham						2967	
	Vienna						2936	
	Other: Specify _____ _____ _____							
Canned meat	Bully beef							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	Other: Specify _____ _____							
Meat pie	Beef						2939	
	Steak and kidney						2957	
	Cornish						2953	
	Chicken						2954	
	Other							
Hamburger	Bought							
Dried beans/peas/lentils	Soup						3145	
	Salad							
Soya products eg. Toppers	Brands at home now: _____ _____						3196 (Toppers)	
Pilchards in tomato/chilli/brine	Whole						3102	
	Mashed with fried onion							
Fried fish	With batter/crumbs							
	Without batter/crumbs							
Other canned fish	Tuna						3056 (oil)	
	Pickled fish							
	Other: Specify _____							
Fish cakes	Bought: Fried						3080	
	Home made with potato						3098	
Fish fingers	Bought						3081	
Eggs	Boiled/poached						2867	
	Scrambled: milk + fat							
	Fried: Fat							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
Now we come to vegetables and fruit **VEGETABLES AND FRUIT**								
Cabbage	How do you cook cabbage?							
	Boiled, nothing added						3756	
	Boiled with potato and onion and fat							
	Fried, nothing added Fried in							
	Boiled, then fried with potato, onion							
	Other:							
	Don't know							
Spinach/morogo/ beetroot leaves other green leafy	How do you cook spinach?							
	Boiled, nothing added						3913	
	Boiled with fat added Type of fat							
	With onion, tomato, potato							
	With peanuts							
	Other:							
	Don't know							
Tomato and onion gravy	Home made with fat Type of fat							
	Without fat						3925	
	Canned						4192	
Pumpkin (yellow)	How do you cook pumpkin?							
	Boiled, nothing added						4164	
	Cooked in fat and sugar Fat							
	Boiled, little sugar and fat Fat							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	Other							
	Don't know							
Carrots	How do you cook carrots?							
	Boiled, nothing added						3757	
	Boiled, sugar and fat Fat							
	With potato and onion: Fat							
	Raw, salad						3709	
	Chakalaka							
	Other							
	Don't know							
Mealies/ Sweet corn	How do you eat mealies?							
	On cob – fat added Fat							
	On cob – no fat added						3725	
	Creamed sweet corn / canned						3726	
	Whole kernel/canned						3942	
Beetroot	Salad						3699	
	Boiled, nothing added						3698	
Potatoes	How do you cook potatoes?							
	Boiled/baked with skin						4155	
	Boiled/baked without skin						3737	
	Mashed							
	Roasted Fat							
	French fries (chips)						3740	
Sweet potatoes	How do you cook sweet potatoes?							
	Boiled/baked with skin						3748	
	Boiled/baked without skin						3903	
	Mashed							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	Other: _____							
	Don't know							
Salad vegetables	Mixed salad: tomato, lettuce and cucumber						3921	
	Raw tomato						3750	
	Other salad vegetables: _____ _____							
Other vegetables, specify + preparation	_____ _____ _____							
Do you like fruit?		Ye 1		No 2				
Apples							3592	
Pears							3582	
Oranges							3560	
Naartjie							3558	
Grapes							3550	
Peaches	Fresh						3565	
	Canned						3567	
Apricots	Fresh						3534	
	Canned						3535	
Mangoes							3556	
Guavas	Fresh						3551	
	Canned						3553	
Avocado							3656	
Wild fruit/berries	Specify type: _____							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
Dried fruit	Types: _____							
Other fruit	_____ _____							
If subject eats canned fruit: Do you have custard with the canned fruit?			Ye 1			No 2		
Custard	Home made: Milk							
	Commercial eg Ultramel						2716	
BREAD AND BREAD SPREADS								
Bread / Bread rolls	White						3210	
	Brown						3211	
	Whole wheat						3212	
Do you spread anything on the bread?			Always 1		Sometimes 2	Never 3		
Margarine	What brand do you have at home now?							
	Don't know _____							
Peanut butter							3485	
Jam/syrup/honey							3985	
Marmite / Fray bentos / Oxo							4058	
Fish/meat paste							3109	
Cheese	Type: _____							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	_____ _____							
Achaar								
Other spreads	Specify: _____ _____							
Dumpling								
Vetkoek	White flour						3257	
	Whole wheat flour						3324	
Provita, crackers, etc							3235	
Mayonnaise / salad dressing	Mayonnaise						3488	
	Other: Specify _____							
DRINKS								
Tea	English (normal)						4038	
	Rooibos						4054	
Coffee							4037	
Sugar/cup tea or coffee	Tea:						3989	
	Coffee:						3989	
Milk/cup tea or coffee	What type of milk do you use in tea and coffee?							
	Fresh/long life: whole/full						2718	
	Fresh/long life: 2%/low fat						2772	
	Fresh/long life: fat free						2775	
	Whole milk powder Brand: _____						2721 (powder)	

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	Low fat milk powder Brand: _____						2825 (powder)	
	Skimmed milk powder Brand: _____						2825 (powder)	
	Milk blend Brand: _____						2770 (powder)	
	Whitener: type _____ _____							
	Condensed milk						2714	
	Evaporated milk						2715	
	None							
Milk as such	What type of milk do you drink milk as such?							
	Fresh/long life: whole/full						2718	
	Fresh/long life: 2%/low fat						2772	
	Fresh/long life: fat free						2775	
	Condensed milk						2714	
	Sour/maas						2787	
	Other: _____ _____							
Milk drinks	Nestle: _____							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	Milo: _____							
	Flavoured milk: _____							
	Other:							
Yoghurt	Drinking yoghurt						2756	
	Thick yoghurt						2734	
	Low fat sweetened with fruit						2732	
Squash	Sweet O						4027	
	Six O							
	Oros/Lecol – with sugar						3982	
	- artificially sweetener						3990	
	KoolAid						4027	
	Other: _____ _____							
Fruit juice	Fresh/Liquifruit/Ceres						2866	
	Tropica (Dairy –fruit juice mix)						2791	
	Other: _____ _____ _____							
Fizzy drinks	Sweetened						3981	
Coke, fanta, etc	Diet							
Maueu/Motogo							4056	
Home brew								

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
Tlokwe							4039	
Beer							4031	
Spirits							4035	
Wine red							4033	
Wine White							4033	
Other specify	_____ _____ _____							
SNACKS AND SWEETS								
Potato crisps							3417	
Peanuts	Raw						4285	
	Roasted						3458	
Cheese curls, Niknaks, etc							3267	
Raisins							3552	
Peanuts and raisins								
Chocolates	Name: _____ _____ _____							
Candies	Sugus, gums, hard sweets, etc						4000	
Sweets	Toffees, fudge, caramels						3991	
Biscuits/cookies	Type: _____ _____							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	_____							
Cakes and tarts	Type: _____ _____ _____							
Scones								
Rusks	Type: _____ _____							
Savouries	Sausage rolls						2939	
	Samoosas: Meat filling						3355	
	Samoosas: Vegetable filling						3414	
	Biscuits eg bacon kips							
	Other specify: _____ _____							
Jelly							3983	
Baked pudding	Type: _____							
Instant pudding	Milk type: _____							
Ice cream							3483	
Sorbet							3491	
Other specify	_____							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	_____ _____							
SAUCES, GRAVIES AND CONDIMENTS								
Tomato sauce / Worcester sauce							3139	
Chutney							3168	
Pickles							3866	
Packet soups							3165	
Other:	_____ _____							
<u>WILD BIRDS, ANIMALS OR INCECTS</u> (hunted in rural areas or on farms)								
Wild fruit								
<u>MISCELLANEOUS:</u> Please mention any other foods used more than once/two times a week which we have talked about:								

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
INDIGENOUS/TRADITIONAL FOODS/PLANTS/ANIMALS **Please tell me if you use any indigenous plants OR other indigenous foods like mopani worms, locusts ect to eat**								
Specify								

Thank you very much for your cooperation and patience.

Good-bye!