

The development of a strategy to promote fruit and vegetable consumption in South Africa



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AFRIKAANSE TITEL

Die ontwikkeling van 'n strategie om die vrugte en groente inname in Suid-Afrika te bevorder

OPSOMMING

Die teorie is dat 'n vermeerdering in die inname van vrugte en groente beide ondervoeding en oorvoeding, wat beide sigbaar is in Suid-Afrika, sal aanspreek. Vanweë die voedings oorgang duidelik te sien in Suid-Afrika, wat hand aan hand gaan saam met die verhoogde voorkoms van nie-oordraagbare siektes, is die fokus in dié verhandeling op oorvoeding wat dus die probleem van nie-oordraagbare siektes in Suid-Afrika aanspreek.

In die *Global Strategy on Diet, Physical Activity and Health*, geformuleer deur die Wêreld Gesondheid Organisasie (WGO) en ondersteun by die Mei 2004 Wêreld Gesondheid Vergadering, is die vermeerdering van vrugte en groente inname een van die aanbevelings om die risiko faktore vir nie-oordraagbare siektes te verlaag. In September 2004 het 'n gesamentlike Voedsel- en Landbou-organisasie (VLO)/WGO werkswinkel die behoefte vir 'n vermeerdering van die vrugte en groente inname aangespreek. Die resultaat van die werkswinkel was 'n raamwerk wat die ontwikkeling van intervensies vir die bevordering van genoegsame inname van vrugte en groente op nasionale vlak sal lei.

Nie-oordraagbare siektes was die nommer een oorsaak van sterftes in Suid-Afrika in die jaar 2000 en was verantwoordelik vir 37% van die sterftes. Daar is getoon dat vrugte en groente inname die risiko vir kardiovaskulêre siektes, diabetes en kanker kan verlaag. Die totale inname van vrugte en groente deur Suid-Afrikaners kan egter nie gesien word dat dit aan die aanbevole vyf porsies daaglik voldoen nie.

Die lae vrugte en groente inname patrone in Suid-Afrika het uitgedaag op die behoefte om 'n nasionale raamwerk, sensitief tot die huidige situasie aan te neem, deur die bogenoemde raamwerk as verwysing te gebruik.

As beginpunt, is 'n oorsig van die beskikbare literatuur aangaande Suid-Afrikaanse eetpatrone gebruik om die vrugte en groente verbruikers domeine en hul ooreenstemmende verskaffings netwerke te karakteriseer asook om die hindernisse te identifiseer tot die inname van vrugte en groente. Die verbruikers domeine in Suid-Afrika kan gekarakteriseer word as volg: (i) plattelandse kleinboere wat vrugte en groente vir eie inname produseer; (ii) mark afhanklike verbruikers; (iii) gemengde verbruikers; en (iv) institusionele verbruikers. Die mees algemene waargenome hindernisse tot die inname van vrugte en groente is bekostigbaarheid, beskikbaarheid en huishoudelike smaak voorkeure.

Die aanbevole nasionale doelwit vir vrugte en groente inname is vyf porsies per dag. Moontlike aandeelhouers betrokke by die bereiking van hierdie doelwit val primêr onder vier sektore naamlik, publieke sektor, private sektor, nie-staats organisasies en internasionale aandeelhouers. Daar is 'n geleentheid om bestaande nasionale beleid en programme wat nie vrugte en groente in ag neem nie te

hersien. 'n Voorbeeld hiervan is om die hoeveelheid vrugte en groente te spesifiseer wat verpligtend behoort te wees in die Primêre Skool Voedingprogram (PSVP).

Die weg vorentoe sal wees om 'n breër aandeelhouer deelname te betrek, veral op regulerende en staatsvlak, om 'n nasionale koördineringspan te skep. Dit is aanbeveel dat die *5-A-Day for Better Health Trust* die dryfkrag van die hele proses moet wees. Dit moet egter verder gekapasiteer word deur die inwinning van fondse en die uitbreiding van die raad van Trustees en doelwitte. Besprekings moet gehou word met WGO om 'n implementasie werkwinkel, met betrekking tot die voorgestelde raamwerk om vrugte en groente inname te vermeerder, te hou in Suid-Afrika met die nasionale koördineringspan en mees belangrike aandeelhouers. Spesifieke kort-termyn, medium-termyn en lang-termyn doelwitte moet opgestel word vir die span.

Die nasional koördineringspan sal leierskap verskaf op nasionale vlak deur onder andere volhoubare en koste-effektiewe intervensies te ontwikkel deur die voorgestelde raamwerk aan te wend, terwyl daar gefokus word op die mees kwesbare teiken groepe. Van die beplanning tot die implementering van projekte, programme en intervensies, behoort die evaluasie van prosesse en uitkomst te hoë prioriteit te geniet. Die evaluasie en kontrolering van intervensies is 'n aaneenlopende proses en is van onskatbare waarde om die vordering wat gemaak is, of die teiken groep bereik is en/of die intervensie suksesvol is, te bepaal.

ABSTRACT

The theory is that increased intake of fruit and vegetables will address both undernutrition and overnutrition, which are both apparent in South Africa. Because of the nutrition transition evident in South Africa, which goes hand in hand with the increased prevalence of noncommunicable diseases (NCDs), the focus in this dissertation is on overnutrition, hence addressing the problem of NCDs in South Africa.

In the Global Strategy on Diet, Physical Activity and Health developed by the World Health Organization (WHO) and endorsed by the May 2004 World Health Assembly, the increase of fruit and vegetable consumption is one of the recommendations to reduce the risk factors for NCDs. In September 2004, a joint Food and Agricultural Organization (FAO)/WHO workshop addressed the need for a global increased fruit and vegetable consumption. The workshop resulted in a framework that will guide the development of interventions for the promotion of adequate consumption of fruit and vegetables at national level.

Noncommunicable diseases were the number one cause of death in South Africa in the year 2000 and accounted for 37% of the deaths. Fruit and vegetable intake has been shown to reduce the risk for cardiovascular diseases, diabetes and cancer. However, overall intakes of fruit and vegetables for South Africans cannot be regarded as meeting the recommendation of five portions daily.

The low fruit and vegetable consumption patterns of South Africans resulted in the need to adopt a national framework sensitive to the present situation by using the above-mentioned framework as reference.

As starting point, a review of available literature regarding South African eating patterns was used to characterise the fruit and vegetable consumer domains and their corresponding supply networks and to identify barriers to eating fruit and vegetables. The consumer domains in South Africa are characterised as follows: (i) rural small-holders producing fruit and vegetables for own consumption; (ii) market-dependent consumers; (iii) mixed consumers; and (iv) institutional consumers. The most commonly perceived barriers to eating fruit and vegetables are affordability, availability and household taste preference.

The recommended national goal for fruit and vegetable consumption is five portions a day. Possible stakeholders involved in reaching this goal primarily fall under four sectors namely, the public sector, private sector, non-governmental organisations and international stakeholders. There is an opportunity to revise existing national policies and programmes that do not consider fruit and vegetables for example specifying the amount of fruit and vegetables to be mandatory in the Primary School Nutrition Programme (PSNP).

The way forward would be to involve a broader stakeholder participation especially at regulatory and government level to create a national coordinating team. It is suggested that the 5-A-Day for Better Health Trust be the driving force of the whole process. It, however, needs to be capacitated further with regard to

the generation of funds and expansion of the Board of Trustees and objectives. Discussions should be held with the WHO to hold an implementation workshop with regard to the suggested framework for increasing fruit and vegetable consumption in South Africa with the national coordinating team and the most important stakeholders. Specific short-term, medium-term and long-term objectives should be set for the team.

The national coordinating team would provide leadership at national level by *inter alia* developing sustainable and cost-effective interventions through applying the proposed framework, whilst focusing on the most vulnerable target groups. From the planning to the implementation of projects, programmes and interventions, the evaluation of processes and outcomes should be of high importance. The evaluation and monitoring of interventions are a continuous process and invaluable to ascertain the progress made, whether the target group has been reached and/or whether the intervention has been successful.

THE DEVELOPMENT OF A STRATEGY TO PROMOTE FRUIT AND VEGETABLE CONSUMPTION IN SOUTH AFRICA

EXECUTIVE SUMMARY

Introduction

Increased intakes of fruit and vegetables will address both undernutrition and overnutrition, which are both apparent in South Africa. Because of the nutrition transition evident in South Africa, which goes hand in hand with the increased prevalence of noncommunicable diseases (NCDs), the focus in this document is on overnutrition, hence addressing the problem of NCDs in South Africa.

Noncommunicable diseases were the number one cause of death in South Africa in the year 2000 and accounted for 37% of the deaths. Cardiovascular disease as a whole was the second leading cause of death and accounted for 17% of total deaths, with the sub-categories of ischaemic heart disease (IHD) ranking second and stroke fourth.

According to The World Health Report of 2002, low fruit and vegetable intake accounted for 19% of gastrointestinal cancer, 31% of IHD and 11% of stroke worldwide. The report on Diet, Nutrition and the Prevention of Chronic Diseases also acknowledged the importance of consuming fruit and vegetables, therefore, recommending the intake of a minimum of 400 g of fruit and vegetables per day for the prevention of chronic diseases, especially in developing countries. Recognising the growing burden of NCDs, the World Health Organization (WHO) responded by developing the Global Strategy on Diet, Physical Activity and Health. In the strategy for diet, one of the recommendations to reduce risk factors for NCDs is to increase the consumption of fruit and vegetables. To reach this goal, the WHO and the Food and Agricultural Organization of the United Nations (FAO) have formed a partnership around the theme of fruit and vegetable consumption for health.

The WHO and FAO held their first joint workshop in September, 2004. The overall goal of the workshop was to develop a framework to guide the development of interventions to promote adequate consumption of fruit and vegetables in member states. This led to the development of a proposed framework to promote the consumption of fruit and vegetables in South Africa.

The role of fruit and vegetables in noncommunicable diseases

Definition of fruit and vegetables

Edible parts of plants commonly considered as vegetables as well as other foods used as vegetables for example fresh green pulses and sprouts could be included as vegetables. Botanical fruit used as vegetables such as tomatoes, as well as food not even considered as plants such as mushrooms can also be accommodated. The frozen and dried counterpart of all the above would also be eligible for classification as vegetables.

Dry pulses would thus not be considered as vegetables. A possible recommendation would be to include all roots and tubers as vegetables.

Fruit should include all fresh and dried fruit and 100% unsweetened fruit juices, except those classified as vegetables. With regard to canned fruit, no recommendation as yet can be made due to the amount of controversy surrounding the subject. It is recommended that olives and nuts should not be included as fruit, but that avocados should be included.

Consumption of fruit and vegetables in South Africa

Overall intakes of fruit and vegetables for South Africans do not meet the global recommendation of 400 g/day.

Fruit and vegetable intake and the major noncommunicable diseases

A body of evidence supports the role of fruit and vegetable consumption in the prevention of diabetes, cardiovascular diseases and certain cancers. The evidence regarding fruit and vegetable intake and management of body weight are, however, inconclusive.

A strategic framework for promoting fruit and vegetable consumption in South Africa

For the purpose of developing a national framework, the global framework produced at the joint FAO/WHO Workshop - Fruit and vegetables for health, 1-3 September 2004, Kobe, Japan - was used as guiding document.

Guiding principles

First of all, there are certain general principles by which any national project to promote fruit and vegetables in South Africa should abide. They include *inter alia* affordability, availability, accessibility and sustainability.

Consumer domains

Furthermore, in order to design effective interventions to improve fruit and vegetable intake, it is essential to characterise the different consumer domains and their corresponding supply networks and make efforts to understand their consumption behaviours. The South African consumer domains could be classified as follows: (i) rural small-holders producing fruit and vegetables for own consumption; (ii) market-dependent consumers; (iii) mixed consumers; and (iv) institutional consumers.

Consumers generally behave in specific ways according to the domains they are in. For example, the rural small-holder may produce a very limited variety of fruit and vegetables and make use of indigenous vegetables, whilst the market-dependent consumer is cash-dependent and the variety of fruit and vegetables they procure depends mainly on the variety provided by retailers, street vendors, etc. The most commonly perceived barriers to the intake of fruit and vegetables in general are affordability, availability and household taste preference.

Stakeholders

The recommended national goal for fruit and vegetable consumption is five portions a day. The most important stakeholders involved in reaching this goal come from four broad sectors namely: (i) the public sector; (ii) private sector; (iii) non-governmental organisations and (iv) international bodies. Selected important stakeholders corresponding to the sectors include: (i) the Department of Health, Department of Agriculture; (ii) producer organisations, fresh produce markets; (iii) consumer groups, 5-A-Day for Better Health Trust; (iv) WHO, FAO and the International Fruit and Vegetable Alliance (IFAVA).

National coordinating team, goals and objectives

A national coordinating team, selected from the list of possible stakeholders should be the driving force in implementing the framework in South Africa. The national goal toward which South Africa should be striving is that of increasing individual fruit and vegetable consumption to 400 g/day. As a long-term objective it is suggested that it should be attempted to reach this goal in the target group within 20 years. It is useful to use the 5-A-Day concept as introduced by the 5-A-Day for Better Health Trust, referring to the number of fruit and vegetable portions which need to be consumed daily. Setting generic as well as specific objectives will aid in reaching the national fruit and vegetable consumption goal.

Existing national policies and action plans

An opportunity exists to up-date, integrate or revise national policies that do not consider fruit and vegetables. Selected existing legislation and policies that need to be considered when planning a fruit and vegetable promotion programme include *inter alia* the Primary School Nutrition Programme (PSNP), National Health Act and the Integrated Food Security Strategy.

Possible interventions at national level

Examples of possible interventions are provided in the report of the FAO/WHO Workshop on Fruit and vegetables for health. It would be the task of the suggested national coordinating team in South Africa to plan and implement both production and consumption interventions in rural, urban and peri-urban settings.

Recommendations

It is recommended that the driving force of the above mentioned process should be South Africa's 5-A-Day for Better Health Trust. The trust has the capacity to provide the leadership in implementing the suggested framework. A few changes need to take place, however, in order for the Trust to fulfil its full potential.

The following step would be to set up a meeting with the following entities:

- Directorate Nutrition (Department of Health)
- Agri SA
- Fresh produce markets
- Scientific bodies *inter alia* the Nutrition Society of South Africa (NSSA) and universities
- Directorate Plant Production Systems (Department of Agriculture)

- Relevant health professionals including the Association for Dietetics in South Africa (ADSA).

The goal of the meeting would be to identify the most important stakeholders involved in the promotion of fruit and vegetables in South Africa. The establishment of partnerships with the relevant identified stakeholders is crucial and should be an ongoing process. A meeting should be set up where all the identified most important stakeholders are present to appoint a national coordinating team.

Furthermore, discussions could be held with the WHO to hold an implementation workshop in South Africa, with regard to the suggested framework for increasing fruit and vegetable consumption, preferably with the national coordinating team and most important stakeholders. After the suggested workshop, objectives need to be set for the national coordinating team, whereafter the implementation of the framework, as described above, should take place.

Throughout the whole process from planning to implementation of projects, interventions or programmes, the evaluation of processes and outcomes should be done regularly to monitor impact and motivate adjustments to the programme.

LIST OF ABBREVIATIONS

A

ADSA	Association for Dietetics in South Africa
APAC	Agricultural Produce Agents Council
ARC	Agricultural Research Council
ARIC	Atherosclerosis Risk in Community Study
AU	African Union

B

BLSA	Baltimore Longitudinal Study of Aging
BMI	Body mass index

C

CANSA	Cancer Association of South Africa
CCRD	Consumer and Corporate Regulation Division
CGIAR	Consultative Group in International Agricultural Research
CHD	Coronary heart disease
COPD	Chronic obstructive pulmonary disease
CSIR	Council for Scientific and Industrial Research
CVD	Cardiovascular disease

D

DALY	Disability Adjusted Life Years
DFPT	Deciduous Fruit Producers' Trust

F

FAO	Food and Agricultural Organization of the United Nations
FEDHASA	Federated Hospitality Association of South Africa
FEDSAW	Federation of South African Women
FPMA	Fresh Produce Marketing Association

G

g	gram
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H

HDL-C	High-density lipoprotein cholesterol
HPCSA	Health Professionals Council of South Africa

I

IFAD	International Fund for Agricultural Development
IFAVA	International Fruit and Vegetable Alliance
IFPRI	International Food Policy Research Institute
IHD	Ischeamic heart disease
IMASA	Institute of Market Agents of South Africa
IMSA	Institute of Market Masters of South Africa
INP	Integrated Nutrition Programme
IPGRI	International Plant Genetic Resource Institute
ISRDS	Integrated Sustainable Rural Development Strategy
IUNS	International Union of Nutritional Sciences

L

LRAD	Land Redistribution for Agricultural Development
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M

MRC	Medical Research Council
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N

NAFU	National African Farmers Union
NAMC	National Agricultural Marketing Council
NCD	Noncommunicable disease

NCF	National Consumer Forum
NCI	National Cancer Institute
NEPAD	New Partnership for Africa's Development
NFCS	National Food Consumption Survey
NHANES	National Health and Nutrition Examination Survey
NHIS	National Health Information Systems
NSSA	Nutrition Society of South Africa
O	
OR	Odds ratio
P	
PBH	Produce for Better Health Foundation
PEM	Protein-energy malnutrition
PPECB	Perishable Products Export Control Board
PSNP	Primary School Nutrition Programme
R	
RR	Relative risk
RuDasa	Rural Doctors Association of Southern Africa
S	
SAAPA	South African Apple and Pear Producers' Association
SAD	South African Dried Fruit
SADA	South African Diabetes Association
SADC	Southern African Development Community
SAFVCA	South African Fruit and Vegetable Canning Association
SANCRA	Southern African New Crop Research Association
SANCU	South African National Consumer Union
SARPN	Southern African Regional Poverty Network
SASPA	South African Stone Fruit Producers' Association
SAT	South African Table Grapes
T	
TAU SA	Transvaal Agricultural Union of South Africa
U	
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations Children Fund
USA	United States of America
USDA	United States Department of Agriculture
W	
WFP	World Food Programme
WHO	World Health Organization
WHR	Waist/hip ratio
WTO	World Trade Organization
Y	
YLL	Years of Life Lost

LIST OF TABLES

Table 1.1 Fruit and vegetables and their association with over and undernutrition	16
Table 1.2 Estimated cause of death profile and YLLs by sex, South Africa, 2000	19
Table 1.3 Top 20 single causes of death ranked in descending order by number of deaths and YLLs for persons, South Africa, 2000	20
Table 2.1 Fruit and vegetable subgroups consumed by children and adults in rural areas of South Africa	34
Table 2.2 Fruit and vegetable subgroups consumed by children and adults in urban areas of South Africa	34
Table 2.3 Analyses that examined the association between fruit and vegetable consumption and body weight	36
Table 2.4 Studies of dietary advice to increase fruit and vegetables where weight loss was not the primary objective	38
Table 2.5 Studies of dietary advice to increase fruit and vegetables and decrease fat intake where weight loss was not the primary objective	39
Table 2.6 Studies of dietary advice to increase fruit and vegetables and decrease fat intake where weight loss was the primary objective	40
Table 2.7 Epidemiological studies reporting measures of association between intake of fruit and vegetables and diabetes mellitus	43
Table 2.8 Prospective studies reporting measures of association between the intake of whole fruit and vegetables and ischaemic heart disease	45
Table 2.9 Prospective studies reporting measures of association between the intake of whole fruit and vegetables and stroke	47
Table 2.10 Summary of overall grading of cancer-preventive effect of the consumption of fruit and vegetables	50
Table 3.1 Possible stakeholders of fruit and vegetable promotion in the public sector in South Africa.....	71
Table 3.2 Possible stakeholders of fruit and vegetable promotion in the private sector in South Africa	78
Table 3.3 Possible non-governmental organisations/civil society which are stakeholders of fruit and vegetable promotion in South Africa	83
Table 3.4 Possible international and regional stakeholders of fruit and vegetable promotion.....	87
Table 3.5 Possible interventions to promote the consumption of fruit and vegetables	98
Table 3.6 Framework for the evaluation of nutrition and nutrition-related programmes in South Africa ..	101

LIST OF FIGURES

Figure 1.1 Noncommunicable diseases: interrelationships and risk factors	17
Figure 1.2 Global distribution of burden of disease attributable to 20 leading selected risk factors.....	18
Figure 1.3 Cause of death by category, South Africa 2000.....	21
Figure 1.4 Flow of events to the development of a strategy to increase fruit and vegetable consumption in South Africa.....	24
Figure 2.1 Pictorial presentation of specific roots and tubers.....	29
Figure 3.1 Structure of the framework to increase fruit and vegetable consumption in South Africa.....	57
Figure 3.2 Structure of the categorisation of stakeholders involved in fruit and vegetable promotion.....	70
Figure 4.1 Practical steps to the implementation of a national framework to promote fruit and vegetables in South Africa.....	113

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	i
OPSOMMING	ii
ABSTRACT	ii
EXECUTIVE SUMMARY	vi
LIST OF ABBREVIATIONS	x
LIST OF TABLES	xii
LIST OF FIGURES	xiii
 CHAPTER 1: INTRODUCTION	 16
1.1 Definition of noncommunicable diseases	17
1.2 The global dilemma of noncommunicable diseases	18
1.3 Noncommunicable diseases in South Africa	19
1.4 The role of diet in prevention of noncommunicable diseases	22
1.5 Importance of a strategy to promote fruit and vegetable consumption	23
1.6 Objectives	25
1.7 Organisation of the dissertation	25
1.8 References	26
 CHAPTER 2: LITERATURE REVIEW: Scientific evaluation of the role of fruit and vegetables in noncommunicable diseases	 28
2.1 Introduction	28
2.2 Definition of fruit and vegetables	28
2.2.1 <i>Fruit and vegetable portion sizes</i>	32
2.2.2 <i>Consumption of fruit and vegetables in South Africa</i>	33
2.3 Fruit and vegetable intake and management of body weight	36
2.3.1 <i>Strength of the evidence</i>	36
2.4 Fruit and vegetable intake and diabetes	42
2.4.1 <i>Strength of the evidence</i>	42
2.5 Fruit and vegetable intake and cardiovascular diseases	44
2.5.1 <i>Strength of the evidence</i>	44
2.6 Fruit and vegetable intake and cancer	49
2.6.1 <i>Strength of the evidence</i>	49
2.7 Conclusion	52
2.8 References	53
 CHAPTER 3: A STRATEGIC FRAMEWORK FOR PROMOTING FRUIT AND VEGETABLE CONSUMPTION IN SOUTH AFRICA	 57
3.1 Guiding principles for programmes	58
3.2 Fruit and vegetable consumer domains and supply networks	59

TABLE OF CONTENTS (continued)

3.2.1	<i>Characteristics of fruit and vegetable consumer domains and supply networks</i>	60
3.2.2	<i>Entry points</i>	65
3.2.3	<i>Barriers to fruit and vegetable consumption and/or promotion</i>	67
3.2.3.1	<i>General barriers</i>	67
3.2.3.2	<i>Specific barriers according to consumer domains</i>	68
3.3	Identification of stakeholders and coordinating team.....	70
3.4	National coordinating team	91
3.4.1	<i>Constitution of a national coordinating team</i>	91
3.4.2	<i>Roles of the national coordinating team</i>	91
3.5	Identification of national goals and objectives.....	92
3.5.1	<i>Considerations regarding goal setting</i>	93
3.6	Existing national policies and action plans.....	95
3.7	Possible interventions at national level	98
3.8	Monitoring and evaluation	99
3.9	Limitations of the strategy	103
3.10	Summary	103
3.11	References	105
CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS		111
4.1	References.....	114

CHAPTER 1

1 INTRODUCTION

The main aim of this dissertation is to develop a framework for the promotion of fruit and vegetables in South Africa. The theory is that increased intakes of fruit and vegetables will address both undernutrition and overnutrition, which are both apparent in South Africa. Undernutrition mostly includes undernourishment, micronutrient malnutrition and protein-energy malnutrition (PEM), whilst overnutrition usually refers to eating more than needed to cover the body's nutrient needs, usually resulting in overweight or obesity (King & Burgess, 2003) and, therefore, also contributing to the development of noncommunicable diseases (NCDs).

Low fruit and vegetable intake has been associated with the development of certain NCDs for example cardiovascular diseases (CVDs), diabetes (Bazzano, 2005) and cancer (WHO/FAO Expert Consultation, 2003), as well as with micronutrient malnutrition (Whitney *et al.*, 1998). Globally, low fruit and vegetable intake are evident (Wolf *et al.*, 2005; Government of India, 1998; Heimendinger & Van Duyn, 1995) and in South Africa, the same situation is present (Nel & Steyn, 2002). Recognising the growing burden of NCDs, the World Health Organization (WHO) retaliated by developing the Global Strategy on Diet, Physical Activity and Health (WHO, 2004). One of its recommendations to reduce the risk factors for NCDs, is to increase the consumption of fruit and vegetables.

Fruit and vegetables have a low energy-density, they are rich in a variety of vitamins, minerals and other nutrients and contain approximately 95% water (Whitney *et al.*, 1998). Because of the inherent properties of fruit and vegetables, they are well suited as an intervention impacting on both over and undernutrition. Table 1.1 shows the different nutrients involved in over and undernutrition, together with the specific properties of fruit and/or vegetables which can act as a possible solution to the problem.

Table 1.1 Fruit and vegetables and their association with over and undernutrition (compiled from Whitney *et al.*, 1998)

UNDERNUTRITION		OVERNUTRITION	
Nutrients involved	Problem corrected by fruit and vegetables	Nutrients involved	Problem corrected by fruit and vegetables
Low energy intake	Root vegetables: rich in carbohydrates = energy Fruit: good source of sugar = energy	High energy intake	Vegetables: low energy-density Fruit and vegetables: up to 95% water
Low protein intake	Dark and medium green leaves: more protein than other vegetables	High fat, protein, refined carbohydrates	Vegetables: no fat, small amounts of protein, starch and sugar
Micronutrient malnutrition	Orange fruit and vegetables: rich in vitamin A Citrus fruit: rich in vitamin C Most fresh vegetables: good sources of vitamin C and	Low fibre intake	Fruit and vegetables: 2-3 g fibre

	folate Some green vegetables and especially dried fruit: source of iron Dark and medium green leaves: source of riboflavin, folate, vitamin A		
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Because of the nutrition transition evident in South Africa, which goes hand in hand with the increased prevalence of NCDs, the focus in this dissertation will be on overnutrition, hence addressing the problem of NCDs in South Africa.

1.1 Definition of noncommunicable diseases

Chronic diseases of lifestyle are a group of diseases that share similar risk factors as a result of exposure over a number of years to unhealthy diets, smoking, lack of exercise and possibly, stress. The interrelationship between chronic diseases of lifestyle and their related risk factors are figuratively portrayed in Figure 1.1 (Bradshaw *et al.*, 1995). The major risk factors include high blood pressure, tobacco addiction, high blood cholesterol, diabetes mellitus and obesity. These risk factors alone or in combination result in various disease processes such as strokes, heart attacks, tobacco and nutrition-induced cancers, chronic bronchitis, emphysema and many others which culminate in high mortality and morbidity rates (MRC, 2001). Internationally these diseases are also called NCDs or degenerative diseases.

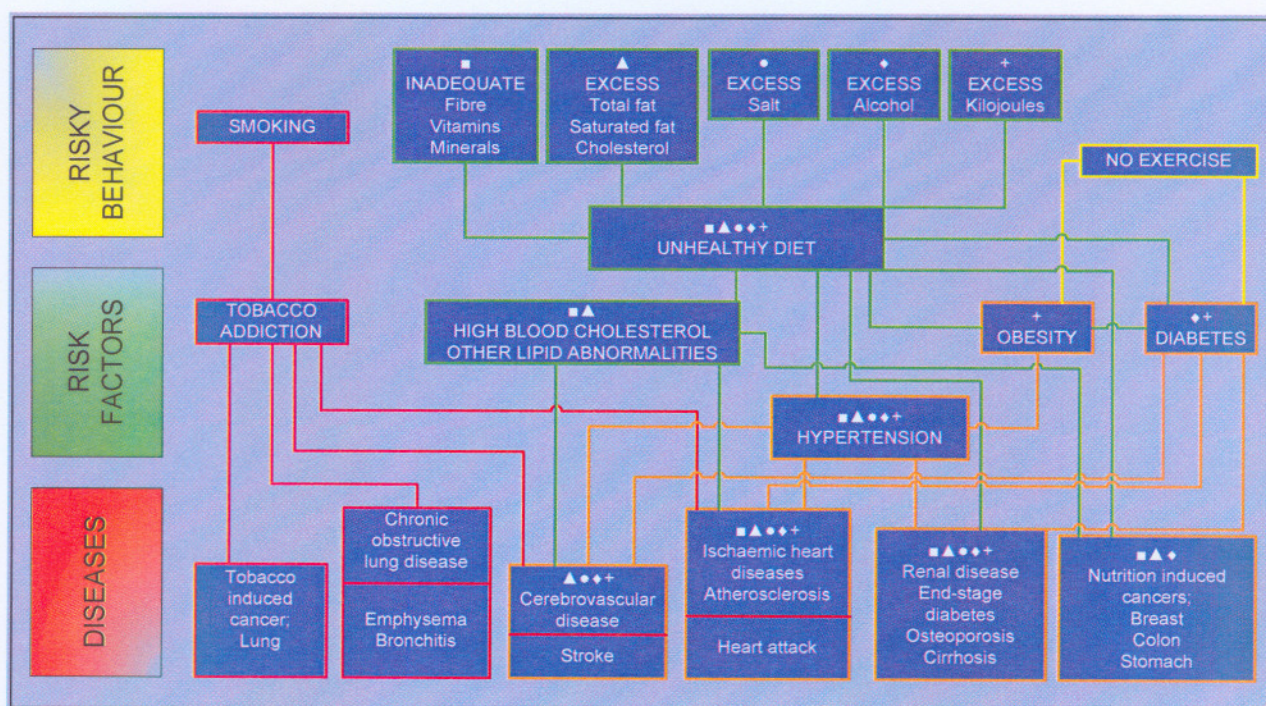


Figure 1.1 Noncommunicable diseases: interrelationships and risk factors (adapted from Bradshaw *et al.*, 1995)

1.2 The global dilemma of noncommunicable diseases

The recent World Health Report (WHO, 2002) presented the global risk factor assessment that describes the amount of disease, disability and death in the world today that can be attributed to a selected number of the most important risks to human health. As an introduction, an overall view of the current situation and trends of NCDs at the global level are given.

Noncommunicable diseases, especially CVDs, cancer, type 2 diabetes and obesity are currently responsible for more deaths annually than any other cause (FAO/WHO, 2005). According to the World Health Report, mortality, morbidity and disability attributable to the major NCDs, account for approximately 60% of all deaths and 47% of the global burden of disease. These figures are expected to rise to 73% and 60% respectively by 2020 (WHO, 2002).

Figure 1.2 taken from the World Health Report shows the global distribution of the burden of disease measured in Disability Adjusted Life Years (DALYs) attributable to the 20 leading risk factors, by level of development: 1) developed countries; 2) developing countries with low mortality and 3) developing countries with high mortality (WHO, 2002). It is clear from the illustration that low fruit and vegetable intake ranks under the top 15 leading risk factors of the global burden of disease experienced.

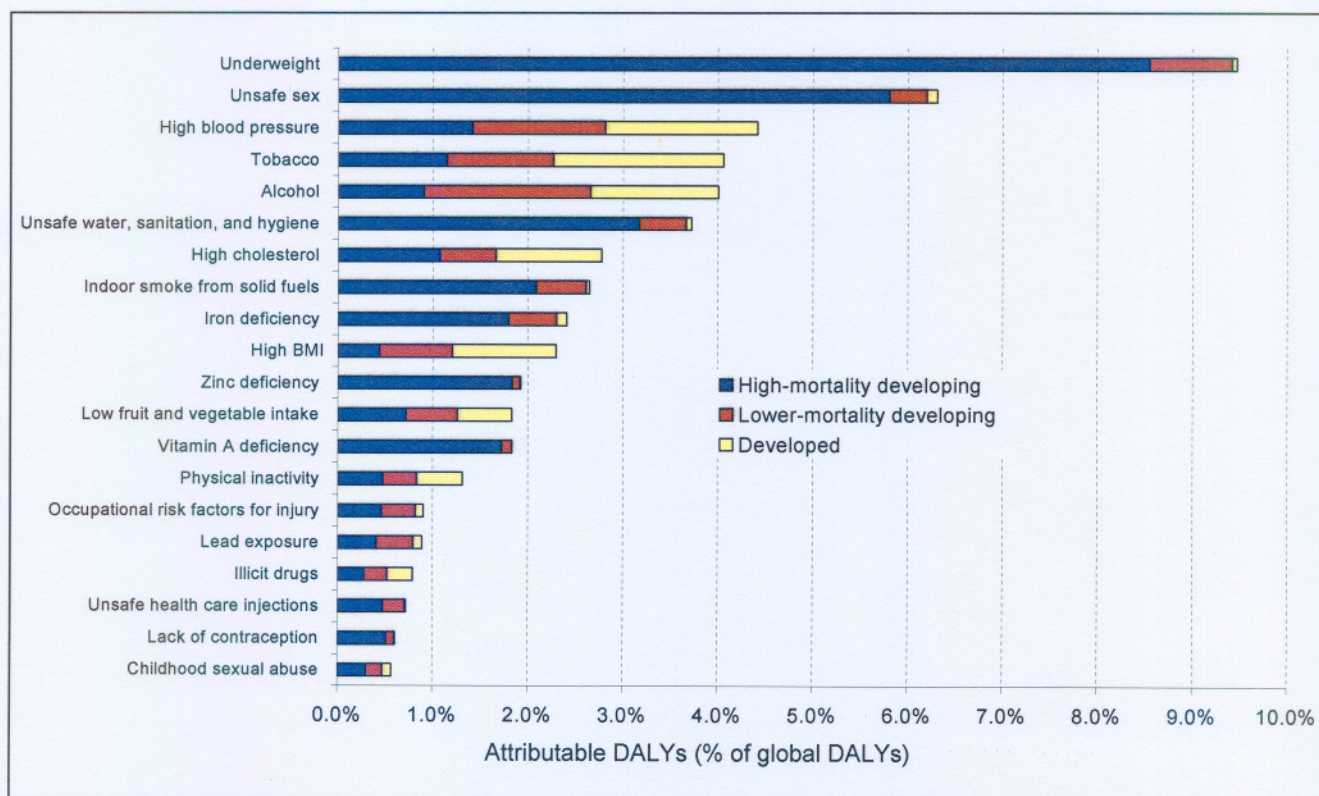


Figure 1.2 Global distribution of burden of disease attributable to 20 leading selected risk factors (adapted from WHO, 2002)

BMI: body mass index; DALYs: disability adjusted life years

The problem of chronic diseases is far from being limited to the developed regions of the world. It is alarming to note that 66% of the deaths attributed to NCDs occurs in developing countries where those affected are on average younger than in developed countries (WHO, 2002).

The results from the global burden of disease study show that the loss of health in the world is dominated on the one hand by those risk factors that affect the poorest regions and populations such as undernutrition, poor water, sanitation and hygiene and indoor smoke from solid fuels and, on the other hand, by risk factors associated with a Western lifestyle, such as excessive alcohol intake, tobacco use, high blood pressure and high cholesterol.

1.3 Noncommunicable diseases in South Africa

The global burden of disease study went a long way to inform the disease patterns that can be expected for South Africa. The need, however, arose for South Africa to carry out a national burden of disease study.

The first South African National Burden of Disease study (Bradshaw *et al.*, 2003) was completed by the Burden of Disease Research Unit of the South African Medical Research Council and is an initial attempt to derive coherent and consistent estimates of the burden of disease experienced in South Africa in the year 2000. This section will focus on the contribution of NCDs to the burden of disease experienced by South Africans.

The most prominent NCDs in South Africa include CVDs, cancer, chronic obstructive pulmonary disease (COPD) and diabetes (Reddy, 2004). Noncommunicable diseases were the number one cause of death in South Africa in the year 2000. As shown in Table 1.2, NCDs accounted for 37% of the deaths and 21% of years of life lost (YLLs) due to premature mortality in 2000, with females having more deaths from NCDs than males (40% versus 36%), but proportions for YLLs for males and females being very similar (Bradshaw *et al.*, 2003).

Table 1.2 Estimated cause of death profile and YLLs by sex, South Africa, 2000 (adapted from Bradshaw *et al.*, 2003)

	Male		Female		Persons	
	Deaths (N = 303081)	YLLs (N = 6529811)	Deaths (N = 253504)	YLLs (N = 5438011)	Deaths (N = 556585)	YLLs (N = 11967822)
HIV/AIDS	26%	33%	34%	47%	30%	38%
Pre-transitional causes ^a	21%	22%	20%	24%	21%	25%
Noncommunicable causes	36%	20%	40%	21%	37%	21%
Injuries	17%	22%	6%	8%	12%	16%

N: number of persons; YLLs: years of life lost

^a Includes communicable diseases, maternal causes, perinatal conditions, and nutritional deficiencies. HIV/AIDS is part of this group, but kept separate due to the size of the burden it contributes

According to Reddy and colleagues, hypertensive heart disease, diabetes mellitus, chronic obstructive airways disease, asthma, oesophageal cancer and cirrhosis of the liver all rank among the top 20 causes of deaths in South Africa (Reddy, 2004). Furthermore, these diseases contribute considerably to the YLLs due to premature mortality (see Table 1.3). As illustrated in Figure 1.3, CVD as a whole is the second leading cause of death in South Africa and accounts for 17% of total deaths, with the sub-categories of ischaemic heart disease (IHD) ranking second and stroke fourth (Bradshaw *et al.*, 2003). The process of estimating the proportion of deaths attributable to selected risk factors in South Africa was still in process when writing this dissertation.

Table 1.3 Top 20 single causes of death ranked in descending order by number of deaths and YLLs for persons, South Africa, 2000 (adapted from Bradshaw *et al.*, 2003)

Single causes	Number of deaths	Rank	Rank	Single causes	YLLs
HIV/AIDS	165 859	1	1	HIV/AIDS	4 665 410
Ischaemic heart disease	32 919	2	2	Homicide violence	902 592
Homicide violence	32 485	3	3	Tuberculosis	595 277
Stroke	32 114	4	4	Road traffic accidents	489 979
Tuberculosis	29 553	5	5	Diarrhoeal diseases	452 827
Lower respiratory infections	22 097	6	6	Lower respiratory infections	449 010
Road traffic accidents	18 446	7	7	Low birth weight	393 763
Diarrhoeal diseases	15 910	8	8	Stroke	318 083
Hypertensive heart disease	14 233	9	9	Ischaemic heart disease	284 438
Diabetes mellitus	13 157	10	10	Protein-energy malnutrition	171 433
COPD	12 473	11	11	Suicide	163 544
Low birth weight	11 876	12	12	Diabetes mellitus	145 421
Nephritis/nephrosis	7 225	13	13	Hypertensive heart disease	127 066
Trachea/bronchi/lung cancer	7 173	14	14	Fires	123 400
Asthma	6 987	15	15	Septicaemia	115 247
Suicide	6 370	16	16	COPD	113 499
Septicaemia	6 047	17	17	Neonatal infections	96 819
Oesophageal cancer	5 803	18	18	Asthma	94 069
Cirrhosis of liver	5 672	19	19	Nephritis/nephrosis	93 973
Protein-energy malnutrition	5 511	20	20	Bacterial infections	90 964

COPD: chronic obstructive pulmonary disease

-----> downward shifts in the above ranking

————> upward shifts in the above ranking

The mortality profile reflected in Tables 1.2 and 1.3 and Figure 1.3 clearly shows the quadruple burden of disease experienced by South Africa, with HIV/AIDS, chronic diseases, poverty-related conditions and injuries all appearing among the top 20 causes of death.

When looking at the prevalence of the most common NCDs and their corresponding risk factors amongst South Africans, it is firstly seen that overall South African males and females have an approximate lifetime risk (0 – 74 years) of developing cancer of 1 in 5 and 1 in 6, respectively. These figures, however, differ between populations where the LR of black South African males of developing cancer, excluding skin cancer, is 1 in 7 people, for coloureds 1 in 5, and for whites and Indians 1 in 4. In females, the approximate LR of developing cancer, excluding skin cancer, is 1 in 8 people for blacks, 1 in 7 for coloureds, 1 in 5 for Indians and 1 in 4 for whites (Sitas *et al.*, 1996).

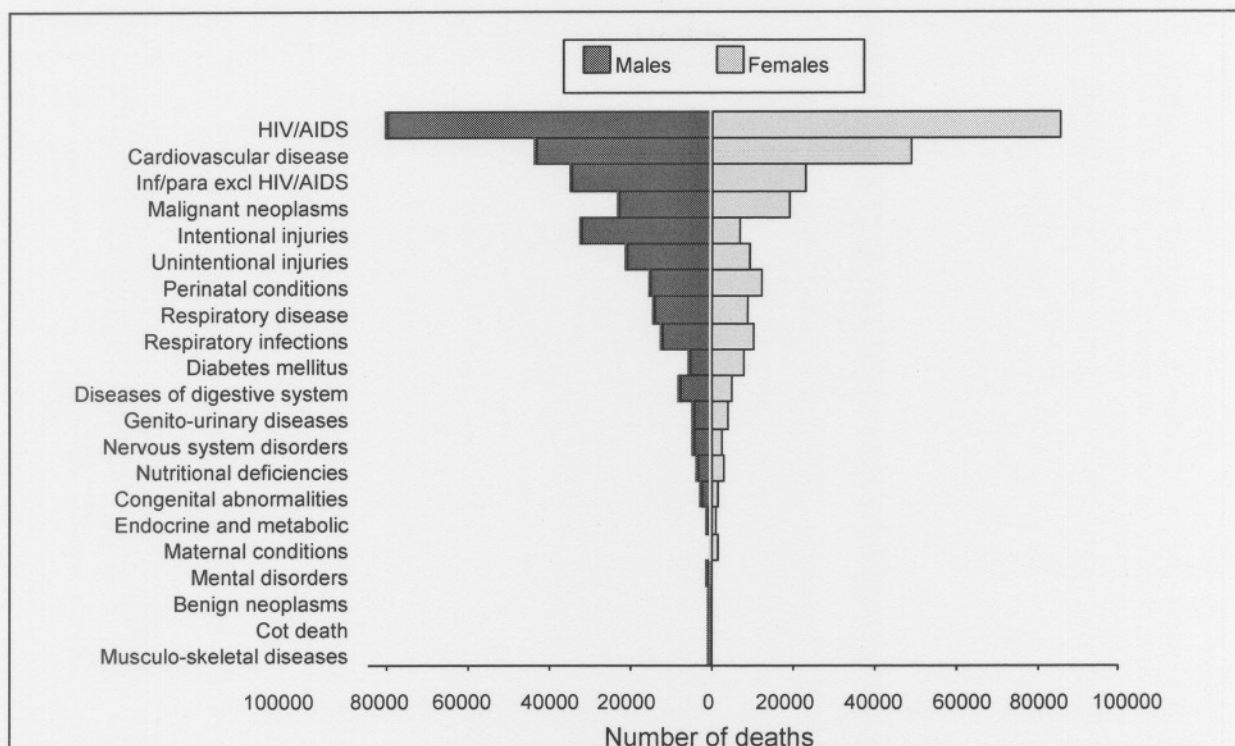


Figure 1.3 Cause of death by category, South Africa 2000 (adapted from Bradshaw *et al.*, 2003)

Inf/para excl: infectious and parasitic excluding

With regard to CVD, most of the risk factors for coronary heart disease (CHD), namely hypertension, dyslipidaemia, smoking, type 2 diabetes mellitus, obesity, physical inactivity and heredity are common in South African populations with high CHD prevalence (Seftel *et al.*, 1995).

Hypertension is the most common reported chronic illness among all South Africans. The prevalence of hypertension among persons aged 16 – 64 years is 16% for Indians, 25% for coloureds, 26% for whites and 33% for urban blacks (Opie, 1995). The prevalence of hypertension is highest among black women and white men (Vorster, 2002). Hypertension among urban blacks is not caused by any inherent ethnic differences as recognised by Opie (1995), seeing that previously the incidence of hypertension was only 2% – 8% among rural blacks. The process of urbanisation may, however, increase the risk of hypertension considerably (Vorster, 2002). Despite the increasing prevalence's of hypertension, smoking, obesity and perhaps diabetes mellitus among blacks, CHD is still relatively uncommon (Love & Sayed, 2001).

According to Seftel and co-workers, raised total serum cholesterol is pandemic among South African adults (Seftel *et al.*, 1995). An interesting observation though, is that black men and women have low mean serum total cholesterol levels compared with other South Africans. Almost all blacks have high-density lipoprotein cholesterol (HDL-C) levels above 20% of total cholesterol, indicative of a protective effect against IHD (Seftel *et al.*, 1995).

It appears that the black population in South Africa may be protected from IHD by a favourable lipid profile. However, with continued urbanisation and corresponding increases in total fat and animal protein

intake, signs of transition of the lipid profile to that of a typical urban population are becoming evident (Oosthuizen *et al.*, 2002). The incidence of heart disease is, therefore, likely to increase among blacks, especially females older than 35 years, where the prevalence of obesity is high (Mollentze *et al.*, 1995; Oelofse *et al.*, 1996).

In the South Africa Demographic and Health Survey, self-reported diabetes rates were 2% for men and 4% for women. Diabetes rates increased with age and were higher in urban than non-urban settings for both genders. The most frequent reported prevalence of diabetes was in Asian participants, especially women (Department of Health, 1998).

Using data from the South Africa Demographic and Health Survey, Puoane *et al.* (2002) ascertained the determinants of obesity in South Africans. The mean body mass index (BMI) values for men and women were 22.9 kg/m² and 27.1 kg/m² respectively. For men, 29.2% were overweight or obese (BMI $\geq$ 25 kg/m²) and 9.2% demonstrated abdominal obesity, which is a waist/hip ratio (WHR) at or above 1.0. In women, 56.6% were found to be overweight or obese and 42% had abdominal obesity (WHR >0.85). It was also reported that obesity increased with age and that higher levels of obesity were found in urban African women.

As a concluding remark, it is evident that NCDs have a substantial contribution to the burden of disease experienced in South Africa and is indeed a matter of concern that needs to be addressed urgently.

1.4 The role of diet in prevention of noncommunicable diseases

As stated in the Global Strategy on Diet, Physical Activity and Health, all countries for which data are available have principally the same underlying determinants of NCDs. Factors identified in the strategy that increase the risk of NCDs include: elevated consumption of energy-dense, nutrient-poor foods, high in fat, sugar and salt; reduced levels of physical activity and tobacco use. The strategy also stressed that of particular concern are unhealthy diets, inadequate physical activity and energy imbalances in children and adolescents (WHO, 2004). A summative overview of the evidence regarding the relationship between diet and the most prominent NCDs is given below.

Diabetes:

Type 2 diabetes results from an interaction between genetic and environmental factors. The rapidly changing incidence rates, however, suggest that environmental factors play a particularly important role. The most dramatic increases in type 2 diabetes are occurring in societies in which there have been major changes in the type of diet consumed, reductions in physical activity and increases in overweight and obesity. The diets concerned are typically energy-dense, high in saturated fatty acids and depleted of non-starch polysaccharides (WHO/FAO Expert Consultation, 2003).

Cardiovascular disease:

According to the joint WHO/FAO Expert Consultation (2003), present mortality rates for CVDs, as mentioned earlier, are the result of previous exposure to behavioral risk factors such as improper nutrition,

insufficient physical activity and increased tobacco consumption. Unhealthy dietary practices include the high intake of saturated fats, salt and refined carbohydrates, together with the low intake of fruit and vegetables (WHO/FAO Expert Consultation, 2003).

A reduced risk of CVD has been shown convincingly with the increased consumption of fruit (including berries) and vegetables, fish and fish oils (eicosapentaenoic acid and docosahexaenoic acid), foods high in linoleic acid and potassium and low to moderate alcohol intake. There is convincing evidence that myristic and palmitic acids, trans fatty acids, high sodium intake, overweight and high alcohol intake contribute to an increase in risk of CVD. Risk factors that have a 'probable' level of decreasing risk of CVD are α -linolenic acid, oleic acid, non-starch polysaccharides, wholegrain cereals, nuts (unsalted), folate and plant sterols and stanols. No relationship exists for stearic acid and CVD. There is a 'probable' increase in risk from dietary cholesterol and unfiltered boiled coffee. 'Possible' associations exist for consumption of flavonoids and soy products and a reduced risk, while for increased risk, 'possible' associations include fats rich in lauric acid, β -carotene supplements and impaired fetal nutrition (WHO/FAO Expert Consultation, 2003).

Cancer:

According to Doll and Peto (1996), dietary factors are estimated to cause approximately 30% of cancers in industrialised countries. This proportion is estimated to be in the region of 30% for developing countries (Willett, 1995).

To date, research has uncovered few definite relationships between diet and cancer risk. For instance, it is shown that consumption of fruit and vegetables have a 'probable' decreasing risk on incidence of cancer, while the intake of soya, fish, n-3 fatty acids, carotenoids, vitamins B₂, B₆, folate, B₁₂, C, D and E, calcium, zinc, selenium and non-nutrient plant constituents have a 'possible/insufficient' level of evidence for a decreasing risk. On the other hand, there is convincing evidence that among other things, obesity, overweight and excessive alcohol intake can increase the risk of developing cancer. Factors which 'probably' increase risk include high dietary intake of preserved meats, salt-preserved foods and salt and very hot (thermally) drinks and food (WHO/FAO Expert Consultation, 2003).

1.5 Importance of a strategy to promote fruit and vegetable consumption

Fruit and vegetables are an important component of a healthy diet. According to the World Health Report, low fruit and vegetable intake accounted for 19% of gastrointestinal cancer, 31% of IHD and 11% of stroke worldwide (WHO, 2002). Furthermore, Lock and co-workers estimated the global burden of disease attributable to low consumption of fruit and vegetables and concluded that fruit and vegetable consumption of 600 g/day (the baseline of choice) could reduce the total worldwide burden of disease by 1.8% (Lock *et al.*, 2005). Fruit and vegetable consumption could reduce the burden of IHD and ischaemic stroke by 31% and 19% respectively and reduce the burden of certain cancers by 2% to 20%. In the flow diagram presented in Figure 1.4, the flow of events from the findings of the World Health Report described above, until the development of a proposed strategy to increase fruit and vegetable consumption in South Africa are illustrated.

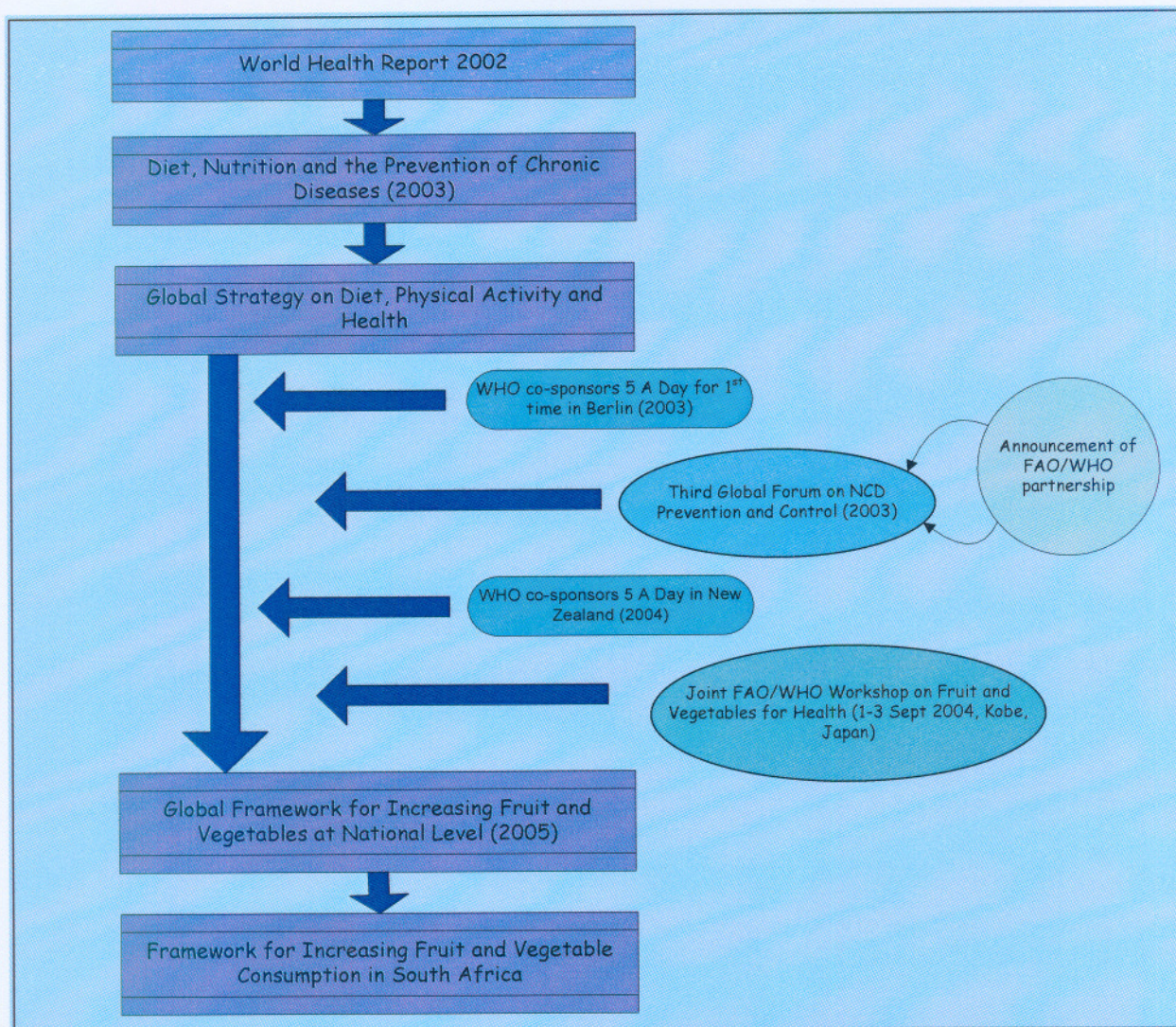


Figure 1.4 Flow of events to the development of a strategy to increase fruit and vegetable consumption in South Africa

The recent report on Diet, Nutrition and the Prevention of Chronic Diseases also acknowledged the importance of consuming fruit and vegetables, therefore, recommending the intake of a minimum of 400 g of fruit and vegetables per day for the prevention of chronic diseases, especially in developing countries (WHO/FAO Expert Consultation, 2003).

Recognising the heavy and growing burden of NCDs, the WHO responded by developing the Global Strategy on Diet, Physical Activity and Health endorsed at the Fifty-seventh World Health Assembly on 22 May 2004 (WHO, 2004). The strategy addresses two of the main risk factors for NCDs, namely diet and physical activity. For diet, one of the recommendations to reduce risk factors for NCDs is to increase the consumption of fruit and vegetables. To reach this goal, the WHO and Food and Agricultural Organization of the United Nations (FAO) formed a partnership around the theme of fruit and vegetable consumption for health. In the meantime, the WHO had discussions on supporting the 5 A Day initiative which was started in 1991 by the National Cancer Institute (NCI) and the Produce for Better Health Foundation (PBH). In January 2003, the WHO, for the first time, co-sponsored a 5 A Day meeting in Berlin.

At the Third Global Forum on NCD Prevention and Control held in Rio de Janeiro, Brazil, in November 2003, the WHO and FAO announced their joint effort to increase worldwide awareness that fruit and vegetable consumption needs to be augmented. Furthermore, the WHO co-sponsored the fourth international 5 A Day symposium held in New Zealand in August 2004. The WHO and FAO held their first joint workshop at the WHO Centre for Health Development in Kobe, Japan on 1-3 September, 2004. The overall goal of the workshop – Fruit and vegetables for health – was to develop a framework to guide the development of effective and cost-efficient interventions to promote adequate consumption of fruit and vegetables in member states. This led to the development of a proposed framework to promote the consumption of fruit and vegetables in South Africa.

1.6 Objectives

The overall purpose of this dissertation is to formulate a strategic framework for promoting fruit and vegetables in South Africa.

In more specific terms, the aims of this dissertation are:

- To characterise the different fruit and vegetable consumer domains and supply networks in South Africa and identify known relevant barriers to fruit and vegetable consumption
- To identify the stakeholders in the fruit and vegetable demand as well as supply side
- To identify existing national goals and objectives with regard to the theme of fruit and vegetables
- To identify existing national policies and action plans that may impact on fruit and vegetable consumption and production
- To provide examples of possible interventions or areas of action to promote fruit and vegetables for each consumer domain.

1.7 Organisation of the dissertation

In Chapter 1, the overall significance of fruit and vegetable intake and its association with over and undernutrition is stated. The focus, however, is on NCDs and specific reference is made to the prevalence of NCDs in South Africa. Furthermore, an overview is given of the role of diet in the prevention of NCDs. Thereafter, the importance of a strategy to increase fruit and vegetable consumption in South Africa is stressed and the specific objectives of the dissertation are stipulated.

Chapter 2 gives a scientific overview of the role of fruit and vegetables in the prevention of the major NCDs. Introductory to the overview, a closer look is taken at the definition of fruit and vegetables and recommendations are made for the classification thereof, sensitive to the situation experienced in South Africa. Furthermore, fruit and vegetable portion sizes as well as the consumption of fruit and vegetables in South Africa are discussed.

The suggested framework for the promotion of fruit and vegetables in South Africa is presented in Chapter 3, using the format of the global framework produced at the joint FAO/WHO Workshop - Fruit and vegetables for health, in Kobe, Japan. The justification for primarily making use of bullets in this chapter is because the report of the FAO/WHO was used as an example; hence predominantly the same layout was

used. Another reason for its use is that it enables the reader to identify specific points discussed easily and effectively.

Finally, conclusions together with recommendations and practical actions that need to be taken in South Africa are given in Chapter 4.

It was decided that after each chapter the relevant references will be given. The references will be listed according to the guidelines provided by the North-West University.

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CHAPTER 2

2 LITERATURE REVIEW: Scientific evaluation of the role of fruit and vegetables in noncommunicable diseases

2.1 Introduction

Despite recent advances in prevention and treatment, NCDs remain a major public health problem in both developed and developing countries. In the South Africa Demographic and Health Survey (Department of Health, 2002), 2% of men and 4% of women reported having diabetes. With regard to overweight and obesity, Puoane *et al.* (2002) estimated that 29.2% of men and 56.6% of women demonstrated BMI's at or above 25 kg/m². Cardiovascular disease as a whole was the second leading cause of death in the year 2000 in South Africa, with the sub-categories of IHD and stroke ranking second and fourth respectively (Bradshaw *et al.*, 2003). With regard to cancer, according to Sitas *et al.* (1996), South African males and females have an approximate lifetime risk of developing cancer of 1 in 5 and 1 in 6, respectively.

Diet has long been linked to the development of chronic diseases (WHO/FAO Expert Consultation, 2003) and dietary modification is one of the cornerstones of chronic disease prevention. The health benefits of a diet rich in fruit, vegetables and legumes has also been recognised for some time (Bazzano, 2005). A substantial amount of evidence exists that relates the nutrients contained in fruit and vegetables with decreased risk of CVDs (as summarised by Bazzano, 2005). These nutrients include dietary fibre, folate, antioxidant vitamins and potassium. A number of nutrients present in fruit and vegetables have also been associated with the decreased risk in developing cancer. These include fibre, carotenoids, vitamins C and folate (as summarised by the WHO/FAO Expert Consultation, 2003). Furthermore, as summarised by the WHO/FAO Expert Consultation (2003), non-starch polysaccharides (which fruit and vegetables are rich in) have been associated with a probable decreased risk in developing type 2 diabetes. The benefit of fruit and vegetables, however, cannot be ascribed to a single or mix of nutrients and bioactive substances (WHO/FAO Expert Consultation, 2003). The examination of single nutrients in relation to chronic disease risk may, therefore, ignore the biochemical complexity of whole foods.

In this literature review, the definition and portion sizes of fruit and vegetables, as well as fruit and vegetable consumption in South Africa are briefly discussed. Thereafter, the evidence regarding the intake of whole fruit and vegetables in relation to body weight, diabetes, CVDs (IHD and stroke) and cancer are critically evaluated.

2.2 Definition of fruit and vegetables

The definition of fruit and vegetables differs from country to country. According to the Columbia electronic encyclopedia (2003), there is no clear botanical distinction between vegetables and fruit; the term vegetable was hence originally used for any plant. Very broadly the term vegetable refers to edible plants which are commonly collected and/or cultivated for their nutritional value by humans (IARC, 2003). Another definition of vegetables is "(i) a plant cultivated for an edible part; (ii) the edible part of such a

plant” (American heritage® dictionary of the English language, 2004). The Columbia electronic encyclopedia (2003) defines fruit as “matured ovary of the pistil of a flower, containing the seed” and the New dictionary of cultural literacy (2002) states that in botany, fruit refers to “the part of a seed-bearing plant that contains the fertilized seeds capable of generating a new plant”. The term fruit includes both fleshy fruit, as well as dry fruit with specific characteristics of the ripened ovary wall, such as cereal grains, pulses and nuts.

Although the use of botanical definitions would be more precise, definitions based on the cultural use of foods are commonly used, as they correspond better to what is understood by subjects in the research setting (IARC, 2003). According to Agudo (2005), any definition of fruit or vegetables should be nutritionally meaningful and take into account which foods were included in studies reporting healthy effects of fruit and vegetable consumption. Nutritionally, fruit and vegetables have a low energy-density, are rich in vitamins, minerals and other bioactive compounds and are good sources of fibre (WCRF/AICR, 1997). The benefit of fruit and vegetables cannot be ascribed to a single or specific mix of nutrients and bioactive substances (WHO/FAO Expert Consultation, 2003).

Some herbs and spices as well as plant products used to make coffee, tea or chocolate are classified under specific food groups other than vegetables. Similarly, foods derived from fruit and vegetables, but with reduced nutritive value (e.g. jams and jellies) are usually regarded as sweets or sugars in most classifications. Among major groups of plant-based foods, cereals constitute a category clearly identified as different from fruit and vegetables. They contain in average 70% starch in weight but they are also a valuable source of protein and fibre, mainly in the form of wholegrain cereals. Cereals are the starchy staples in most diets and contribute to a substantial part of energy intake in many parts of the world (WCRF/AICR, 1997). According to Vorster and Nell (2001), maize has been traditionally used as staple food in South Africa.

More controversy exists about the inclusion of the following two food groups as vegetables:

1. Potatoes and tubers; and
2. Legumes or pulses.

Included in potatoes and tubers are also sweet potatoes, yams, taro and cassava (see Figure 2.1). They contain variable amounts of starch from 12% to 50% (Agudo, 2005).



Figure 2.1.1 Cassava



Figure 2.1.2 Taro

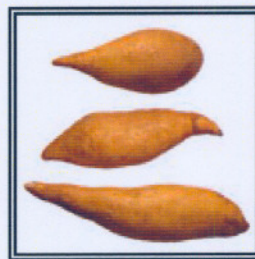


Figure 2.1.3 Yam



Figure 2.1.4 Sweet potato

Figure 2.1 Pictorial presentation of specific roots and tubers

Most countries, including the United States of America (USA) group potatoes within the vegetable group, however, some categorise them into the grain group (Painter *et al.*, 2002). South Africa has adopted the USA Food Guide Pyramid and, therefore, also categorises them as vegetables. In the joint WHO/FAO report, Diet, Nutrition and the Prevention of Chronic Diseases, it is recommended that the category of tubers (i.e. potatoes, cassava) should not be included in fruit and vegetables when setting national nutrient intake goals (WHO/FAO Expert Consultation, 2003).

According to Venter and Van Eyssen (2001), legumes can be separated into two classes: (a) oilseeds such as soybeans and peanuts and (b) grain legumes, including common beans, lentils, lima beans, cowpeas, chickpeas and common peas. Beans, peas and lentils are also known as “pulses” (Venter & Van Eyssen, 2001) which are derived from the fruits and seeds of a number of leguminous plants (Agudo, 2005). Legumes are rich in starch, vegetable protein, dietary fibre, oligosaccharides, phytochemicals and minerals (Venter & Van Eyssen, 2001).

Although legumes are in most cases included within vegetables, dry beans are often placed into the protein-rich foods together with meat and fish. In the case of South Africa, following the USA Food Guide Pyramid, legumes, including kidney beans and chickpeas, are classified within the vegetable group while dry beans are grouped with meat, poultry and fish (Painter *et al.*, 2002). In the South African Food-Based Dietary Guidelines, legumes constitute a separate guideline: “Eat dry beans, peas, lentils and soya often” (Vorster *et al.*, 2001).

With regard to fruit, the situation is not much less debated. There is first of all no consensus about the inclusion of nuts as fruit. Nuts are energy-dense with most energy coming from fat (Agudo, 2005). They are, however, low in saturated fatty acids and high in unsaturated fatty acids. Nuts are also important sources of plant protein, dietary fibre, antioxidant vitamins, minerals and numerous bioactive substances (Kris-Etherton *et al.*, 2001). The same applies to other botanical fruit with high energy content such as olives and avocados. Mostly, nuts are categorised in the protein-rich food groups, while avocados are regarded as fruit and olives are placed in the fat and oil group (Painter *et al.*, 2002).

According to Agudo (2005), 100% fruit juices can provide most of the micronutrients present in the original fruit. Caution needs to be administered though when classifying fruit juices within the fruit group seeing that fibre is lost and in some cases sugar is added as sucrose or de flavoured, clarified, concentrated apple juice. Another reason for concern is that many products are labelled as “fruit drinks” although they contain very little of the original fruit.

Another issue that has to be raised is that of frozen, dried and canned fruit and vegetables. Firstly with respect to frozen, the freezing process is the least destructive on the nutritive content of vegetables (as summarised by Prochaska *et al.*, 2000) and fresh produce that has been on the shelf long past its harvest date may actually be lower in nutrients than food that is frozen immediately after picking (McWilliams, 2001). Traditionally fruit and vegetables are dried during summer for use in winter in many cultures. This happens both commercially and at home and most of the properties of the original food are preserved in

this process (Agudo, 2005). This tendency was also seen in South Africa in the Northern Province where *morogo* (green leafy vegetable) is consumed throughout the year. Surplus from summer months are usually dried for use during winter (Steyn *et al.*, 2001). Canned fruit and vegetables raise more concern than their frozen and dried counterpart. In a literature and database survey on the effects of food processing on the nutritive value of foods, Prochaska *et al.* (2000) concluded that canning of foods is the most destructive method of processing with regard to nutrients. As an example, from 70% to 75% decreases in vitamin C content are observed in spinach, carrots and beets (Wisker *et al.*, 1994). Other decreases of nutrients found in fruit and/or vegetables due to the canning process are *inter alia* riboflavin, niacin, thiamin, biotin, vitamins A, D and K and panthothenic acid (Prochaska *et al.*, 2000).

It is essential to acknowledge what consumers regard as fruit and vegetables. In a study by Love *et al.* (2001), women in Kwazulu-Natal and the Western Cape were selected according to settlement type and ethnicity to test the preliminary South African Food-Based Dietary Guidelines. All the consumer groups identified common fruit and vegetables such as bananas, apples, spinach, pumpkin, etc. All the groups also regarded fruit juices as fruit. Canned and dried fruit were also mentioned by some groups. Specific groups included *imfino* (dark-green leafy vegetable) and pumpkin leaves, canned baked beans, frozen vegetables, mushrooms and leeks as vegetables. Some participants queried the categorisation of potatoes and avocados (Love *et al.*, 2001).

In conclusion it is necessary to recommend what should be considered as fruit and vegetables specifically for South Africans as it will influence how consumption data is interpreted, what specific foods will be promoted in fruit and vegetable programmes, nutrition and agricultural policies, etc.

As recommended by Agudo (2005) in the background paper for the joint FAO/WHO Workshop on Fruit and vegetables for health, 1-3 September 2004, Kobe, Japan, it may be practical to use the term "vegetables and foods used as vegetables". In this way edible parts of plants commonly considered as vegetables as well as other foods used as vegetables for example fresh green pulses and sprouts as well as fresh and sweet corn could be included. Botanical fruit used as vegetables such as tomatoes, peppers, cucumbers or eggplants as well as food not even considered as plant, such as mushrooms and seaweed (depending on the classification) can also then easily be accommodated (Agudo, 2005). The frozen and dried counterparts of all the above would also be eligible for classification as vegetable.

Dry pulses would thus not be considered as vegetables. This will not mean that its intake should not be promoted. As a matter of fact, by separating pulses from vegetables and constituting an individual guideline as with the South African Food-Based Dietary Guidelines, the consumption of pulses receives enough emphasis. Contrary to the recommendations of Agudo (2005) and the joint WHO/FAO report on Diet, Nutrition and the Prevention of Chronic Diseases (WHO/FAO Expert Consultation, 2003), a possible recommendation would be to include all roots and tubers as vegetables. The reason for inclusion would be that roots and tubers could make a significant contribution to energy intake, especially in areas where they are indigenous.

Fruit should include all fresh and dried fruit and 100% unsweetened fruit juices, except those classified as vegetables. With regard to canned fruit, no recommendation as yet can be made due to the amount of controversy surrounding the subject.

It is recommended that olives and nuts should not be included as fruit due to possible over-consumption on the one side and the affordability thereof by lower socio-economic classes on the other. Despite the high energy content of avocados they should be included, due to the fact that they contain 9.8 g monounsaturated fatty acids per 100 g (USDA, 2004) and are fresh fruit.

In conclusion, it is important to emphasise the inclusion of a variety of fruit and vegetables in the diet and to be sensitive to cultural uses and habits of consumption of fruit and vegetables of the South African population. It is recommended that when fruit and vegetables are prepared, the healthiest method of cooking or preparing be used.

2.2.1 Fruit and vegetable portion sizes

Many countries have adopted the recommendation to eat at least 400 g fruit and vegetables per day. It is however, noteworthy to have an idea of the amount of fruit and vegetables people actually eat at each consumption occasion.

In the EPIC-Norfolk study in the United Kingdom, serving sizes for different fruit and vegetables were estimated from 7-day food diaries. The results of the study showed that the geometric mean weight of a serving of fruit and vegetables combined was 86.2 g, but average servings tend to be larger for fruit than vegetables. The largest servings were observed for commonly eaten fruit such as apples, bananas and oranges, whilst average serving sizes for frequently consumed vegetables such as carrots, peas, broccoli and cauliflower were less than 80 g (Ashfield-Watt *et al.*, 2004).

Similar to the above mentioned study, the EPIC project, performed in ten European countries, found the mean portion size for vegetables was 68.1 g while it was 127 g for fruit. Potatoes and tubers had a higher mean portion size of approximately 156 g. Other related findings were that average portions were larger for men than for women for both fruit and vegetables, without showing any pattern of difference by education. People eating higher amounts of vegetables also consumed larger portions, while that was not the case with the consumption of fruit (Agudo *et al.*, 2002; Slimani *et al.*, 2002).

In South Africa, the international recommendation of 400 g of fruit and vegetables per day (WHO/FAO Expert Consultation, 2003) has become established as a manageable, minimum recommendation and has been included in the National Food-Based Dietary Guidelines by stating: "Eat plenty of vegetables and fruit every day" and then referring to five portions per day (Department of Health, 2004). This has been translated into the campaign, "5-A-Day for Better Health" (5-A-Day for Better Health Trust, 2004) advocating eating five portions of fruit and vegetables daily and adopting the well-known simple message of "5 A Day", initiated in the USA (PBH & NCI, 1999).

In the South African Food-Based Dietary Guidelines, definitions of portions are provided. The fruit and vegetable recommendation is defined as 3 – 5 portions of vegetables and 2 – 4 portions of fruit. One portion is defined as follows: 1 cup free vegetables (asparagus, broccoli, cabbage, eggplant, green beans, lettuce, radishes, tomatoes); ½ cup of other vegetables (peas, beetroot, carrots, pumpkin, onions, butternuts); medium apple, peach, orange, grapefruit, pear, 1 small banana or mango; 4 apricots or prunes; 20 – 24 medium grapes or strawberries; 4 tablespoons raisins; ½ cup sliced fruit (Department of Health, 2004). The definitions of portions described by 5-A-Day for Better Health, look very similar to the description provided above (5-A-Day for Better Health Trust, 2004).

It is also important to recognise how consumers interpret portion sizes. With regard to the South African Food-Based Dietary Guideline: “Eat plenty of fruit and vegetables every day”, interpretations of the word “plenty” emphasised the frequency as well as the quantity of consumption. Numeric values ascribed to the word “plenty” ranged from a minimum of one fruit and one vegetable to as many as 5 – 9 fruit and/or vegetables a day (Love *et al.*, 2001).

In summary, since most recommendations recommend eating five or more portions or 400 g of fruit and vegetables a day, it is often assumed that a standard portion is approximately 80 g. According to Agudo (2005), it seems that this reference portion is appropriate on average, but actual portions consumed tend to be lower for vegetables and higher for fruits. A wide variability exists in this quantification of a portion across countries as well as between persons in the same country, thus the average consumption of 80 g portions is more permissible when a variety of fruit and vegetables is consumed. The advice of eating a variety of fruit and vegetables should, therefore, always be clear in food guidelines (Agudo, 2005).

2.2.2 Consumption of fruit and vegetables in South Africa

A low consumption of fruit and vegetables is a persistent global phenomenon. Recent national surveys in the USA showed that only 23% – 32% of Americans met the national recommendation of 5 – 9 servings of fruit and vegetables daily and that mean consumption is 3.1 – 3.8 servings/day (Cohen *et al.*, 1998; Heimendinger & Van Duyn, 1995). In many regions of the developing world, consumption of fruit and vegetables is lower, as shown by the findings of food consumption surveys (WHO/FAO Expert Consultation 2003). As an example, nationally representative surveys in India indicate a fixed level of fruit and vegetable consumption of 120 – 140 g per capita per day, with another 100 g per capita from roots and tubers and some 40 g per capita from pulses (Government of India, 1998). According to the WHO/FAO Expert Consultation (2003), this may, however, not be true for urban populations in India, who have rising incomes and probable greater diversity in diet.

Tables 2.1 and 2.2 show fruit and vegetable consumption in rural and urban South Africa. They are adapted from the report by Nel and Steyn (2002) on South African food consumption studies amongst different population groups from the period 1983 – 2000. Roots were included in the interpretation of fruit and vegetable consumption data, whilst olives and nuts were excluded and a portion was considered as 80 g of fruit and/or vegetables. It should be noted that in the analyses of the data by Nel and Steyn (2002) processed fruit and vegetables were also included for example canned, frozen, juices potato chips, etc.

Table 2.1 Fruit and vegetable subgroups consumed by children (Labadarios *et al.*, 2000) and adults (Nel & Steyn, 2002) in rural areas of South Africa

Description of food item	CHILDREN: 1 – 5y		CHILDREN: 1 – 9y		ADULTS: 10+y	
	Average g/person/day of those consuming the item	Average per capita g/person/day	Average g/person/day of those consuming the item	Average per capita g/person/day	Average g/person/day of those consuming the item	Average per capita g/person/day
Vegetables:						
Leafy	144.5	27.4	148.1	25.6	182.8	45.9
Brassica	87.5	11.8	98.6	15.4	123.7	17.2
Fruity	100.7	10.8	131.0	15.7	115.7	25.4
Cucurbits	99.1	5.7	135.0	7.4	384.4	9.9
Bulb	23.2	0.6	21.0	0.7	29.8	0.1
Green legumes	160.0	1.4	69.3	0.7	102.6	0.5
Mix	130.0	0.6	37.5	0.2	23.3	1.6
Stem	0.0	0.0	0.0	0.0	51.2	0.0
Fruit:						
Pome	168.8	9.5	264.9	14.6	187.2	7.0
Tropical	94.7	4.9	168.1	8.5	159.9	16.9
Citrus	275.4	6.1	265.0	9.5	323.5	10.0
Stone	195.5	3.8	100.0	0.5	199.4	1.3
Berry	292.5	2.3	228.9	4.9	260.3	1.1
Other	93.3	0.3	160.0	0.4	187.2	0.0
Roots	122.5	26.8	167.4	37.3	207.2	18.5

Table 2.2 Fruit and vegetable subgroups consumed by children (Labadarios *et al.*, 2000) and adults (Nel & Steyn, 2002) in urban areas of South Africa

Description of food item	CHILDREN: 1 – 5y		CHILDREN: 1 – 9y		ADULTS: 10+y	
	Average g/person/day of those consuming the item	Average per capita g/person/day	Average g/person/day of those consuming the item	Average per capita g/person/day	Average g/person/day of those consuming the item	Average per capita g/person/day
Vegetables:						
Leafy	116.5	8.3	107.9	8.6	161.3	24.9
Brassica	70.2	11.2	81.4	11.0	106.2	15.6
Fruity	66.7	10.2	88.8	14.2	114.7	25.3
Cucurbits	88.5	11.9	98.3	12.5	153.9	11.6
Bulb	20.5	0.3	11.4	0.3	20.1	1.0
Green legumes	57.7	1.8	64.7	3.1	84.6	5.1
Mix	81.1	1.1	75.8	1.1	38.3	1.6
Stem	0.0	0.0	0.0	0.0	51.2	0.1

Description of food item	CHILDREN: 1 – 5y		CHILDREN: 1 – 9y		ADULTS: 10+y	
	Average g/person/day of those consuming the item	Average per capita g/person/day	Average g/person/day of those consuming the item	Average per capita g/person/day	Average g/person/day of those consuming the item	Average per capita g/person/day
Fruit:						
Pome	176.2	29.3	184.7	29.1	264.4	32.5
Tropical	101.9	13.1	129.3	9.1	133.5	13.8
Citrus	229.8	18.1	291.8	28.5	283.3	13.0
Stone	139.5	5.8	194.7	11.2	199.6	11.4
Berry	134.9	3.6	159.3	4.8	324.3	11.3
Other	0.0	0.0	0.0	0.0	175.2	0.5
Roots	102.2	31.7	113.9	32.8	187.2	59.1

The data from Nel and Steyn (2002) are the best compiled dataset available in South Africa at present. The published data, however, does not allow calculation of number of portions of fruit and vegetables consumed per day. Further analyses of the data are necessary for accurate calculation of the number of portions consumed per day and falls outside the scope of this dissertation. A few assumptions can, however, be made with regard to the available data presented in Tables 2.1 and 2.2 and are described below.

With regard to children, the National Food Consumption Survey (NFCS) which was undertaken in 1999 served as nationally representative data (Labadarios *et al.*, 2000). For adults, no existing nationally representative data exists and data consequently had to be extrapolated from existing isolated dietary surveys on adults (Nel & Steyn, 2002). Two methods were used when analysing the data. Method 1 results corresponded with results from the NFCS, which was over-sampled for lower socio-economic areas, whereas the results from Method 2 ignored relationships with NFCS data and was based on the ethnic proportions of the population in South Africa (Steyn *et al.*, 2003). For the purpose of identifying the most vulnerable group with regard to fruit and vegetable intake, Method 1 will be used to describe the fruit and vegetable consumption patterns of adults.

When looking at the average gram of fruit consumed per person per day of those consuming the item, it is noteworthy to see that in both rural and urban adults and children more than a portion of every variety of fruit listed are eaten per day. For vegetables, in rural and urban adults and children, a portion or more of the majority of the varieties of vegetables listed are eaten per day by persons consuming the item. Bulb and stem vegetables are the varieties of vegetables that consistently not a portion of are consumed in both rural and urban populations (Nel & Steyn, 2002).

The consumption of fruit and vegetables in South Africa are placed into perspective when looking at the average per capita grams of fruit and vegetables consumed per person per day presented by Nel and Steyn (2002) in Tables 2.1 and 2.2. The consumption of none of the varieties of fruit or vegetables in either the urban or rural populations adds up to 80 g/day. It is interesting to note that in a majority of the

varieties of fruit consumed, rural children and adults consistently consume less per day than their urban counterparts. With regard to vegetables, the consumption of leafy, brassica and fruity vegetables are consistently less by urban children and adults per day, compared to their corresponding rural populations. Another consistent phenomenon is that rural and urban children aged 1 – 5 and 6 – 9 years consume on average less fruit and vegetables per capita per day than rural and urban adults.

It is important to note that since the majority (77%) of the population is black, the final food consumption patterns mostly reflect the typical diet followed by black South Africans (Steyn *et al.*, 2003).

Although the calculation of the number of portions of fruit and vegetables consumed by South Africans per day cannot be estimated from the available data, it is evident that overall intakes of fruit and vegetables do not meet the global recommendation of 400 g daily.

2.3 Fruit and vegetable intake and management of body weight

For the review of the evidence regarding the relationship between fruit and vegetable consumption and body weight, the evidence is primarily adapted from the literature review by Tohill (2005) and summarised accordingly. Tohill (2005) included intervention as well as epidemiological studies published between January 1966 and July 2003.

2.3.1 Strength of the evidence

Recently, Tohill (2005) reviewed the literature regarding the influence of particular food groups on body weight by evaluating intervention as well as epidemiological studies. Little research has addressed the association of fruit and vegetables to body weight directly, although a number of studies have done so indirectly.

When looking at the epidemiological literature reviewed by Tohill (2005), most of the studies were of cross-sectional design, with only one being a prospective study. As summarised in Table 2.3, eight studies on women and five studies on men reported an association between higher fruit and vegetable intake and a lower BMI by level of fruit and vegetable intake. Six studies in women and five in men found no difference in BMI with regard to fruit and vegetable consumption.

Table 2.3 Analyses that examined the association between fruit and vegetable consumption and body weight (adapted from Tohill, 2005)

1 st Author and year	Research design	Analysis and results
Patterson, 1990	Cross-sectional analyses	Regression coefficients to obtain estimates of means. No associated increase in obesity with increasing fruit and vegetable intake. Note: Caloric and fat intake increased as fruit and vegetable intake increased.
LaForge, 1994	Cross-sectional analyses	Descriptive analysis. No significant difference in percentage of adults

1 st Author and year	Research design	Analysis and results
		consuming ≥ 5 servings of fruit and vegetables per day and obesity. Note: 15% of the sample reported usual daily consumption of 5 or more servings of fruit and vegetables.
Gillman, 1995	Cross-sectional analyses	P values for trend test. BMI increased as fruit and vegetable intake increased.
Serdula, 1996	Cross-sectional analysis	Multiple logistic regression models. Women with a BMI ≤ 19 more frequently consumed fruit and vegetables ≥ 5 times per day.
Kahn, 1997	Prospective cohort	Linear and logistic models. Change in BMI and waist gain associated with a greater vegetable intake for men and women.
Tudeau, 1998	Cross-sectional analysis	Multivariate linear regression models. Obese women had lower fruit intake.
Williams, 1999	Cross-sectional analysis	Descriptive analysis. Lower BMI was associated with more consistently frequent vegetable intake.
Liu, 2000	Cross-sectional analysis	Separate trend tests. BMI did not vary appreciably across fruit and vegetable quintiles. Note: Median intake of total fruit and vegetables ranged from 2.6 to >10 servings/d.
Liu, 2001	Cross-sectional analysis.	Baseline descriptive analysis. BMI did not vary by category of vegetable intake.
Terry, 2001	Cross-sectional analysis	Correlation of baseline characteristics and fruit and vegetable intake. No significant difference in BMI among fruit and vegetable quartiles.
Bazzano, 2002	Cross-sectional analyses	ANOVA for continuous variables. Decrease in BMI as frequency of fruit and vegetable intake increased.
Flood, 2002	Cross-sectional analyses	Separate trend tests for fruit and vegetable quintiles. Trend of decreasing BMI with increasing fruit and vegetable quintiles.
Kobayashi, 2002	Cross-sectional analysis.	Descriptive analysis. No significant difference in BMI across quintiles of vegetable intake.
Lahti-Koski, 2002	Four independent cross-sectional surveys.	Logistic regression. Vegetable intake was weakly associated with obesity.
Lin, 2002	Cross-sectional analysis	Regression analysis. Obese men ate fewer fruit and vegetables and more white potatoes. Obese women ate less fruit.
Rissanen, 2003	Cross-sectional analyses	ANOVA comparing groups of mean fruit and vegetable intake. BMI was lower with higher fruit and vegetable intake. Note: All-cause mortality was lower among men with the highest consumption of fruit, berries and vegetables.

BMI: body mass index (kg/m^2)

With regard to the intervention studies, Tohill (2005) reviewed randomised controlled trials in which subjects were advised to increase fruit and vegetable consumption (Table 2.4) and to increase fruit and vegetable consumption together with a reduction in fat intake (Table 2.5). These trials were aimed at reducing risk factors associated with chronic diseases and weight loss was not included as a primary objective. A few trials were also identified that specifically tested advice to increase consumption of fruit and vegetables as a strategy for weight loss (Table 2.6).

The intervention trials that examined whether free-living persons respond to dietary advice to increase fruit and vegetable consumption (juices included), but without weight loss as goal, were not associated with a change in body weight (Table 2.4). Tohill (2005) concluded that these studies, which did not give advice on weight loss, found that the subjects maintained body weight. This suggests that it is important to give advice on the whole diet as well as increasing fruit and vegetables in order for people to maintain their body weight. In shorter-term studies by Bolton *et al.* (1981) and Haber *et al.* (1977), it was found that fruit juice does not have the same effect on satiety as whole fruit. Consumption of juice could thus add excess energy to daily intake while contributing relatively little to satiety.

Table 2.4 Studies of dietary advice to increase fruit and vegetables where weight loss was not the primary objective (adapted from Tohill, 2005)

1 st Author and year	Intervention	Duration	Fruit and vegetables ^a		Weight loss (lb)
			Pre-intervention	Post-intervention	
Zino, 1997	I: ↑F&V (including juice and fried potatoes) Nutritionist counseled: individual counseling C: (usual care)	8 weeks	I: Vegetable: 228±127 Fruit: 93±118 Juice: 56±96 C: Vegetable: 196±87 Fruit: 37±51 Juice: 25±68	I: Vegetable: 332±149†‡g/d Fruit: 256±132†‡ g/d Juice: 413±283†‡ g/d C: Vegetable: 218±104‡g/d Fruit: 55±84‡ g/d Juice: 46±104‡ g/d	None
Maskarinec, 1999	I: ↑F&V (including juice and fried potatoes) Dietician counseled: individual counseling	6 months	I: Vegetable: 1.7 Fruit: 1.5 C: Vegetable: 2.0 Fruit: 1.3	I: Vegetable: 3.9‡ Fruit: 3.5‡ C: Vegetable: 2.1‡ Fruit: 2.0‡	None
Smith-Warner, 2000	I: ↑F&V ^b (including juice and fried potatoes) Nutritionist counseled: individual counseling C: (usual care)	1 year	I: Vegetable: 4.3 Fruit: 2.4 Juice: 0.5 C: Vegetable: 3.7 Fruit: 2.4 Juice: 0.6	I: Vegetable: 5.5‡ Fruit: 4.9‡ Juice: 1.6‡ C: Vegetable: 3.5‡ Fruit: 2.1‡ Juice: 0.6‡	None

I: Intervention group; C: Control group

^a servings per day unless otherwise stated; ^b ↑F&V: subjects were advised to increase fruit and vegetable intake; † significantly different from baseline; ‡ significantly different between groups; ‡ reported as post-hoc analysis;

In summary, the trials that combined advice to increase fruit and vegetable intake and decrease dietary fat but did not prescribe weight loss, found that in one study subjects maintained their body weight while in the other six studies they spontaneously lost weight (Table 2.5). The length of these studies ranged from eight weeks to one year. As shown in Table 2.6, when the same advice was given as part of a weight loss strategy, all of the studies identified, ranging in length of six months to one year, reported significant weight loss (Tohill, 2005).

Table 2.5 Studies of dietary advice to increase fruit and vegetables and decrease fat intake where weight loss was not the primary objective (adapted from Tohill, 2005)

1 st Author and year	Intervention	Duration	Fruit and vegetable intake ^a		Weight loss (lb)
			Pre-intervention	Post-intervention	
Henderson, 1990	I: ↑F&V, ↓fat Dietician counseled: C: Usual care	1 year	I ₁ : Vegetable: 140 Fruit: 132	I ₁ : Vegetable:133↑kcal/d Fruit: 169↑ ^d kcal/d	-6.4
		2 years	C ₁ : Vegetable: 133 Fruit: 142	C ₁ : Vegetable:128 kcal/d Fruit: 143 kcal/d	-1.4
			I ₂ : Vegetable: 140 Fruit: 132	I ₂ : Vegetable:124↑kcal/d Fruit: 185↑ ^d kcal/d	-4.2
			C ₂ : Vegetable: 133 Fruit: 142	C ₂ : Vegetable:128 kcal/d Fruit: 159 kcal/d	-0.2
Singh, 1992	I: ↑F&V, ↓fat Dietician counseled: C: AHA diet	1 year	I: Vegetable and fruit: 172±23.5	I: Vegetable and fruit: 575±91.4 g/d	-13.9
			C: Vegetable and fruit: 165±18.8	C: Vegetable and fruit: 185±25.4 g/d	-5.3
Singh, 1992	I: ↑F&V, ↓fat Dietician counseled: C: AHA diet	3 months	I: Vegetable and fruit: 256.4±23.5	I: Vegetable and fruit: 592.0↑±112.5 g/d	None
			C: Vegetable and fruit: 261.4±47.8	C: Vegetable and fruit: 287.5±65.5 g/d	None
Baer, 1993	I: ↑F&V, ↓fat Dietician counseled: AHA step 1 diet C: Usual care	1 year	I: Vegetable: 2.0 Fruit: 4.0	I: Vegetable: 4.0 Fruit: 6.0	-11
			C: NR	C: NR	+1
Gambera, 1995	I: ↑F&V, ↓fat, ↑ exercise Dietician counseled: AHA step 2 diet C: ↑ exercise only	3 months	I ₁ : Vegetable: 2.3 Fruit: 0.9	I ₁ : Vegetable: 2.6 Fruit: 3.4↑	-4.8
			C ₁ : Vegetable: 1.9 Fruit: 0.6	C ₁ : Vegetable: 2.6 Fruit: 3.9↑	-3.0
			I ₂ : NR	I ₂ : NR	+0.7
			C ₂ : NR	C ₂ : NR	None

1 st Author and year	Intervention	Duration	Fruit and vegetable intake ^a		Weight loss (lb)
Lanza, 2001	I: ↑F&V, ↓fat Dietician counseled: individual and group counseling	1 year	I: Vegetable and fruit: 5.0 C: Vegetable and fruit: 5.0	I: Vegetable and fruit: 7.8‡ 5.4‡ C: Vegetable and fruit: 8.6‡ 5.3‡	-4.3 0 -1.4 0
Rock, 2001	I: ↑F&V, ↓fat (including juice) Dietician counseled: telephone counseling C: No counseling	1 year	I: Vegetable: 3.1 Fruit: 2.7 C: Vegetable: 2.9 Fruit: 2.6	I: Vegetable: 4.9† Fruit: 3.6† C: Vegetable: 3.2† Fruit: 2.6†	None None
Djuric, 2002	Dietician counseled: individual and group counseling (including juice and fried potatoes) I ₁ : ↑F&V ^b I ₂ : ↑F&V, ↓fat ^c I ₃ : ↓fat	1 year	I ₁ : Vegetable: 2.4 Fruit: 1.8 I ₂ : Vegetable: 2.2 Fruit: 2.1 I ₃ : Vegetable: 2.4 Fruit: 1.5	I ₁ : Vegetable: 5.9† Fruit: 5.2† I ₂ : Vegetable: 5.9† Fruit: 4.9† I ₃ : Vegetable: 2.5 Fruit: 1.8	+6 None -5
Singh, 2002	I: ↑F&V, ↓fat Dietician counseled: NCEP diet	2 years	I: Vegetable and fruit: 215±29 C: Vegetable and fruit: 207±23	I: Vegetable and fruit: 573†±127 g/d C: Vegetable and fruit: 231±19 g/d	-8.8 -2.2

AHA: American Heart Association; C: Control group; I: Intervention group; NCEP: National Cholesterol Education Program; NR: not reported

^a servings per day unless otherwise stated; ^b ↑F&V: subjects were advised to increase fruit and vegetable intake; ^c subjects advised to decrease fat intake; ^d reported as a post-hoc analysis

† significantly different from baseline; ‡ significantly different between groups;

Table 2.6 Studies of dietary advice to increase fruit and vegetables and decrease fat intake where weight loss was the primary objective (adapted from Tohill, 2005)

1 st Author and year	Intervention	Duration	Fruit and vegetable intake ^a		Weight loss (lb)
			Pre-intervention	Post-intervention	
Weinsier, 1982	I: ↑F&V, ↓fat Dietician counseled: 1000 kcal/d	6 months	I: NR C: NR	I: ad libitum C: ad libitum	-28.4 -13.6

1 st Author and year	Intervention	Duration	Fruit and vegetable intake ^a		Weight loss (lb)
Stamler, 1997 Tillotson, 1997	I: ↑F&V ^b , ↓fat ^c Dietician counseled: individual and group counseling C: Usual care	6 years	Vegetable: 2.9 Fruit: 3.9 Vegetable: 2.9 Fruit: 3.9 Vegetable: 2.9 Fruit: 3.9 Vegetable: 2.9 Fruit: 3.9 Vegetable: 2.9 Fruit: 3.9	3.8% energy 5.7% energy 4.0% energy 6.4% energy 4.0% energy 7.0% energy 4.4% energy 7.9% energy 5.1% energy 8.8% energy	5+ or more ±5 -5 to -9 -10 to -14 -15 or more
Epstein, 2001	Family counseling: 1200 and 1500 kcal/d I: ↑F&V C: ↓fat and sugar	1 year	I: Vegetable and fruit: 3.8 C: Vegetable and fruit: 4.2	I: Vegetable and fruit: 7.2* C: Vegetable and fruit: 4.0	-16.4 ^e -5.4 ^e
Appel, 2003	Dietitian counseled: individual and group counseling I ₁ : ↑F&V, ↓fat I ₂ : ↓fat C: Single-visit counseling	6 months	I ₁ : Vegetable and fruit: 4.8 I ₂ : Vegetable and fruit: 4.6 C: Vegetable and fruit: 4.4	I ₁ : Vegetable and fruit: 7.8† I ₂ : Vegetable and fruit: 5.1 C: Vegetable and fruit: 4.9	-12.8 -10.8 -2.4

AHA: American Heart Association; C: Control group; I: Intervention group; NCEP: National Cholesterol Education Program; NR: not reported

^a servings per day unless otherwise stated; ^b ↑F&V: subjects were advised to increase fruit and vegetable intake; ^c subjects advised to decrease fat intake; ^d reported as a post-hoc analysis; ^e actual weight losses of parents, personal communication from author
† significantly different between groups; * significantly different from baseline

In summary, Tohill (2005) commented that many of the studies reviewed did not include detailed information on the fruit and vegetables consumed by the subjects. These limitations restrict the possibilities of interpretation and extrapolation of the findings to other populations and communities.

The interpretation of the findings is also hampered by the fact that in many studies foods such as potato chips, fruit juices and tomato sauces were allowed in the category of fruit and vegetables. Many of the studies were also designed for purposes other than to investigate the association of fruit and vegetable consumption with body weight. Thus, the reported associations were in general not adjusted for potential confounders (Tohill, 2005).

In conclusion, longer-term intervention studies and epidemiological evidence have given inconsistent results and on the whole, the association of fruit and vegetables with body weight remained weak and inconsistent.

2.4 Fruit and vegetable intake and diabetes

In the following summary of the strength of the evidence relating fruit and vegetable consumption to the risk of developing diabetes mellitus, the core of the evidence is adapted from the review by Bazzano (2005), which took into consideration all individual level studies (cross-sectional, case-control, prospective cohort studies) published from 1960 to May 2004. A literature search was done to identify any studies published after this time period and is also described in the subsequent section.

2.4.1 Strength of the evidence

The most recent review on the dietary intake of fruit and vegetables and diabetes mellitus was carried out by Bazzano (2005). All individual level studies were included, where the primary outcome was diabetes mellitus, glycosylated haemoglobin or blood glucose and the exposure was fruit or vegetable intake as whole foods. Two cross-sectional, one case-control and five prospective cohort studies were identified and are summarised in Table 2.7.

According to Bazzano (2005), a small, but growing body of evidence links high fruit and vegetable consumption with a lower risk of developing type 2 diabetes mellitus. Of the five prospective studies identified, four reported significant inverse associations of fruit and vegetable intake with diabetes mellitus (Table 2.7, studies 1 – 3; 6), while one found no association (Table 2.7, study 5). This association was first noted among vegetarians who were half as likely as omnivores to develop diabetes over 21 years of follow-up (Snowdon & Phillips, 1985). This link of a higher fruit and vegetable intake with lower risk of diabetes was subsequently noted in non-vegetarian populations as well. The study with the largest sample size was that of the Nurses Health Study and showed a 27% reduced risk with a relative risk (RR) of 0.76 and 95% confidence interval (CI) of 0.50 – 1.16 of developing type 2 diabetes in non-obese women in the highest compared to the lowest quintile of vegetable intake. No association was, however, found for fruit intake (Colditz *et al.*, 1992).

Both of the cross-sectional studies identified, reported significant inverse associations of fruit and vegetable intake and diabetes (Table 2.7, studies 4; 7). Williams and colleagues found that frequent consumption of vegetables throughout the year was inversely associated with risk of having type 2 diabetes with an odds ratio (OR) of 0.16 (95% CI, 0.04 – 0.69) compared with infrequent consumption. A nonsignificant inverse association between frequent consumption of fruit and type 2 diabetes was observed (Williams *et al.*, 1999). In a study of 5 996 men and women, participants who reported frequent consumption of fruit and green leafy vegetables had significantly lower mean percent glycosylated haemoglobin concentrations than their counterparts who reported seldom or never consuming these foods (Sargeant *et al.*, 2001).

Table 2.7 Epidemiological studies reporting measures of association between intake of fruit and vegetables and diabetes mellitus (adapted from Bazzano, 2005)

Author and year	Population	Study design (follow-up)	Notes	Association (95% CI)
¹ (Snowdon & Philips, 1985)	Seventh Day Adventists, California	Prospective cohort (21 years)	Instrument not well described	SMR: 0.45 (0.38 – 0.54)
² (Colditz <i>et al.</i> , 1992)	USA Nurses	Prospective cohort (6 years)	Q5/1 $\geq$ 2.9 servings of vegetables vs. $<$ 1.2	RR Q5/1 vegetable intake: 0.76 (0.50 – 1.16)
³ Feskens, 1995	Finnish and Dutch	Prospective cohort (30 years)	Multivariate regression predicting 2-h post-load glucose	Inverse association of 2-h post-load glucose and intake of vegetables and legumes
⁴ (Williams <i>et al.</i> , 1999)	Residents, Isle of Ely, UK	Cross-sectional	Frequency of consumption: frequent all year vs. infrequent all year	OR for DM vegetable consumption all year: 0.16 (0.04 – 0.69); OR for DM fruit consumption all year: 0.52 (0.26 – 1.05)
⁵ Meyer, 2000	Post-menopausal women, IA, USA	Prospective cohort (6 years)	Q5/1 $>$ 51 servings/wk fruit and vegetables vs. $<$ 23 servings/wk	RR Q5/1 fruit and vegetables: 1.05 (0.84 – 1.31); RR vegetables: 1.07 (0.86 – 1.32); RR fruit: 1.14 (0.93 – 1.39)
⁶ Ford, 2001	NHANES I, USA	Prospective cohort (19 years)	5 or more servings/d vs. 0 serving/d; strong sex interaction	RR: 0.73 (0.54 – 0.98)
⁷ (Sargeant <i>et al.</i> , 2001)	Norfolk region of UK, EPIC study	Cross-sectional	Frequency of consumption $\geq$ 5 times/wk vs. never or seldom	Inverse association of % HbA _{1c} with frequent fruit and green leafy vegetable consumption
⁸ Suzuki, 2002	Rural Japanese	Case-control	OR for high intake frequency of carrot and pumpkin	OR for elevated HbA _{1c} : 0.49 (0.29 – 0.85); OR for DM: 1.21 (0.79 – 1.84)
⁹ (Liu <i>et al.</i> , 2004)	Women's Health Study	Prospective (8.8 years)	Q4/1, 0.92 servings/d green leafy vegetables vs. 0.14 servings/d; Q5/1, 1 serving/d dark yellow vegetables vs. 0.07 servings/d	RR Q4/1 green leafy vegetables: 0.80 (0.68-0.96) [†] ; RR Q5/1 dark yellow vegetables: 0.73 (0.60-0.90) [†]

CI: confidence interval; DM: diabetes mellitus; EPIC: European Prospective Investigation into Cancer and Nutrition; HbA_{1c}: glycosylated haemoglobin; IHD: ischaemic heart disease; NHANES: USA National Health and Nutrition Examination Study; OR: odds ratio; Q: quintile; RR: relative risk; SMR: standardised mortality ratio; Q5/1: quintile 5 vs. quintile 1; Q4/1: quintile 4 vs. quintile 1.

[†] P = 0.02

¹⁻⁹ Study numbering

In summary of the epidemiological evidence, out of the eight studies identified, seven reported significant inverse associations of fruit and vegetable intake with diabetes mellitus. Bazzano (2005) concluded that

the results of the available studies support the role of fruit and vegetables in the prevention of type 2 diabetes.

Since the review by Bazzano (2005), only one study investigating the relationship between fruit and vegetables and diabetes mellitus could be identified. Liu *et al.* (2004) reported no significant association between fruit and vegetable intake and risk of type 2 diabetes after adjustment for known risk factors. However, a significant inverse association between consumption of green leafy vegetables and dark yellow vegetables and risk of type 2 diabetes was found in a subgroup of overweight women after adjustment for known risk factors (see Table 2.7, study 9).

2.5 Fruit and vegetable intake and cardiovascular diseases

For the review of fruit and vegetable intake and risk of CVDs, only prospective studies have been taken into consideration. Three reviews were identified which summarised the effect of fruit and vegetable intake on risk of developing CVDs. The outcomes of the reviews by Ness and Powles in 1997 and later in 1999 are briefly discussed below (Ness & Powles, 1997; Ness & Powles, 1999). The crux of the evidence was adapted from the literature review by Bazzano (2005) who identified studies published from 1966 to May 2004. Any prospective studies identified after May 2004 are also described in the section below. Results for the relationship between fruit and vegetable intake and stroke and IHD respectively are depicted separately.

2.5.1 Strength of the evidence

The evidence regarding fruit and vegetable intake and CVD was reviewed in 1997 (Ness & Powles, 1997) and later in 1999 the evidence regarding fruit and vegetable intake and stroke was reviewed by the same authors (Ness & Powles, 1999). The most recent review was in the form of a background document for the joint FAO/WHO Workshop on Fruit and vegetables for health (Bazzano, 2005).

The review by Ness and Powles (1997) included all ecological, case-control, cohort and unconfounded trials in humans which reported on fruit and vegetable intake or nutrient which could serve as a proxy. They concluded that the results were consistent with a strong protective effect of fruit and vegetables for stroke and a weaker protective effect on CHD. No attempt was, however, made to estimate a summary measure of the association because of the multiple differences in study type, study quality and exposure measures used.

The reviews by Ness and Powles in 1997 and 1999 identified five prospective studies that examined fruit and vegetable intake as whole foods in relation to CVD (Ness & Powles, 1997; Ness & Powles, 1999). Of these studies, three showed significant inverse associations, while the other two studies showed no significant association with CVD. In the most recent review of the association between dietary intake of fruit and vegetables and risk of CVDs (Bazzano, 2005), nine prospective cohort studies were published relating fruit and vegetable intake and IHD since the review by Ness and Powles (1997) (see Table 2.8), while eight were published in relation to stroke since the review by Ness and Powles (1999) (see Table 2.9).

Table 2.8 Prospective studies reporting measures of association between intake of whole fruit and vegetables and ischaemic heart disease (adapted from Bazzano, 2005)

Author and year	Population	Follow-up	Notes	Association (95% CI)
¹ Mann, 1997	Vegetarians in UK	13.3 years	Fresh/dried fruit $\geq 10/\text{wk}$ vs. $<5/\text{wk}$. Carrots $\geq 5/\text{wk}$ vs. $<1/\text{wk}$. Green vegetables $\geq 5/\text{wk}$ vs. $<1/\text{wk}$	RR fruit: 0.89 (0.44 – 1.80) RR carrots: 0.76 (0.37 – 1.57) RR vegetables: 1.34 (0.47 – 3.84)
² Yochum, 1999	Postmenopausal women in USA	10 years	Focus was flavonoid intake, apple intake (times/wk)	RR Q5/1 apples: 0.82 (0.60 – 1.12)
³ (Cox <i>et al.</i> , 2000)	British	7 years	FFQ without portion size, analysis divided by season. Frequent fruit and vegetable consumption vs. never.	M: OR winter salad vegetable: 0.85 (0.72-1.00); OR summer salad vegetable: 0.95 (0.82-1.10); OR for fruit NS. F: OR winter and summer salad vegetable: 0.76 (0.65-0.89); OR winter fruit: 0.84 (0.74-0.94); OR summer fruit: 0.85 (0.74-0.97)
⁴ Liu, 2000	Female health professionals, USA	195 647 person years = 5 years	Intake Q5/1, 10.2 vs. 2.6 servings/d	RR Q5/1: 0.63 (0.38 – 1.17)
⁵ Joshiyura, 2001	Nurses Health and Health Professionals Follow-up, USA	F: 14 years M: 8 years	Q5/1, 2.45 – 2.93 vs. 9.15 – 10.15 servings of total fruit and vegetables/d	RR Q5/1: 0.80 (0.69 – 0.93)
⁶ Liu, 2001	Physicians Health Study, USA	12 years	For participants consuming at least 2.5 servings fruit and vegetables/d compared to less than 1 serving/d	RR: 0.77 (0.60-0.98) for CHD
⁷ (Bazzano <i>et al.</i> , 2002)	NHANES I, USA	19 years	≥ 3 times/d vs. <1 time/d, portion size not part of FFQ	RR: 0.76 (0.56 – 1.03) for IHD death, RR: 0.73 (0.58 – 0.92) for CVD death
⁸ Rissanen, 2003	Finnish men	13 years	Q5 (>408 g/d) vs. Q1 (<133 g/d)	RR Q5/1 fruit, berry and vegetable intake: 0.59 (0.33 – 1.06)
⁹ Steffen, 2003	Adults (ARIC cohort), USA	11 years	Q5 (7.5 servings/d) vs. Q1 (1.5 servings/d)	RR Q5/1 fruit and vegetable intake: 0.82 (0.57 – 1.17)

ARIC: Atherosclerosis Risk in Communities Study; CI: confidence interval; CVD: cardiovascular disease including both ischaemic heart disease and stroke; DM: diabetes mellitus; F: female; FFQ: food frequency questionnaire; IHD: ischaemic heart disease; M: male; MI: myocardial infarction; NHANES: USA National Health and Nutrition Examination Study; NS: not stated; Q: quintile; Q5/1: quintile 5 vs. quintile 1; RCT: randomised controlled trial; RR: relative risk; SMR: standardised mortality ratio; T: tertile.

¹⁻⁹ Study numbering

With regard to fruit and vegetable intake and IHD, four studies found significant inverse associations (Table 2.8, studies 3; 5 – 7), while five found inverse associations, which only trended towards significance (Table 2.8, studies 1 – 2; 4; 8 – 9). Five of the eight studies linking fruit and vegetable intake and stroke found significant inverse associations with fruit and vegetable intake (Table 2.9, studies 2 – 5; 7), while the remaining three studies reported inverse associations which did not reach statistical significance (Table 2.9, studies 1; 6; 8).

With regard to the relationship between fruit and vegetable intake and IHD, Bazzano *et al.* (2002) found a 24% lower IHD mortality (P-value = 0.07) with fruit and vegetable intake of ≥ 3 times per day as compared with less than once per day after a follow-up of 19 years on the population of the National Health and Nutrition Examination Study (NHANES). This study, however, did not report portion size information and used a single 24-hour recall to represent fruit and vegetable intake.

In addition to the study by Bazzano *et al.* (2002), a further three studies reported significant inverse associations between fruit and vegetable intake and IHD (summarised by Bazzano, 2005). Cox and colleagues studied the seasonal consumption of fruit and vegetables in British men and women over a period of seven years and found that frequent salad vegetable consumption was protective for the development of CVD in both summer and winter, while fruit was only protective for women at any season (Cox *et al.*, 2000).

As summarised by Bazzano (2005), five remaining studies found inverse relationships between fruit and vegetable intake and IHD, but the associations failed to reach statistical significance.

As shown in Table 2.9, with regard to stroke, Bazzano *et al.* (2002) found that fruit and vegetable intake of ≥ 3 times per day as compared with less than once per day, significantly lowered the risk of stroke by 27% (P-value = 0.01). Results from the Nurses Health Study and Health Professionals Follow-up Study showed a significant 31% lower risk of stroke for persons in the highest quintile of fruit and vegetable intake as compared to those in the lowest. The overall RR per 1 serving per day was 0.94 (95% CI, 0.90 – 0.99) (Joshi *et al.*, 1999). In the study by Knekt *et al.* (2000) on 9 208 men and women followed-up for 28 years, the intake of apples in quartile four, compared to quartile one were found to lower the risk of stroke in men significantly (RR, 0.65; 95% CI, 0.45 – 0.94).

Table 2.9 Prospective studies reporting measures of association between intake of whole fruit and vegetables and stroke (adapted from Bazzano, 2005)

Author and year	Population	Follow-up	Notes	Association (95% CI)
¹ (Keli <i>et al.</i> , 1996)	Residents of Zutphen, Netherlands	15 years	Intake (g/d) T3/1 solid fruit <41 vs. ≥ 99.8; citrus fruit <28 vs. ≥ 91.7; vegetables <153.2 vs. ≥ 215.8; main focus on flavonoids	RR T3/1 solid fruit: 0.53 (0.21 – 1.31); citrus fruit: 0.93 (0.39 – 2.22); vegetables: 0.82 (0.35 – 1.94)
² (Joshipura <i>et al.</i> , 1999)	Nurses health professionals in USA; follow-up studies pooled	F: 14 years M: 8 years	RR per 1 serving per day	RR: 0.94 (0.90 – 0.99) F: 0.93 (0.87 – 1.00) M: 0.96 (0.89 – 1.03)
³ Hirvonen, 2000	Male smokers in Finland	6.1 years	Qr4/1, >142 g/d vs. <59 g/d vegetables Qr4/1, >120 g/d vs. <32 g/d fruit Qr4/1, >49 g/d vs. <12 g/d berries	RR Qr4/1 vegetables: 0.71 (0.57 – 0.87); RR fruit: 0.96 (0.78 – 1.18); RR berries: 0.81 (0.66 – 1.00)
⁴ (Knekt <i>et al.</i> , 2000)	Several regions of Finland	28 years	M: Qr4/1, >54 g/d vs. 0 g/d apple intake F: Qr4/1, >71 g/d vs. <5 g/d apple intake Main focus was quercetin.	M: RR Qr4/1 apples: 0.65 (0.45 – 0.94) F: RR Qr4/1 apples: 0.95 (0.60 – 1.51)
⁵ (Bazzano <i>et al.</i> , 2002)	NHANES I (USA)	19 years	≥ 3 times/d vs. <1 time/d; portion size not part of FFQ	RR: 0.73 (0.57 – 0.95) for CVA; RR: 0.58 (0.33 – 1.02) for CVA death
⁶ Johnsen, 2003	Danish	168 388 person – year, median 3.09	Q5 median intake 673 g/d vs. Q1 median 147 g/d	RR Q5/1: 0.72 (0.47 – 1.12)
⁷ Sauvaget, 2003	Japanese	18 years	RR for consumption daily vs. 0 – 1 time/wk, no portion size	M: RR green yellow vegetables: 0.77 (0.62 – 0.95); RR fruit: 0.65 (0.53 – 0.80) F: RR green yellow vegetables: 0.81 (0.68 – 0.96); RR fruit: 0.75 (0.64 – 0.88)
⁸ (Steffen <i>et al.</i> , 2003)	Adults in USA (ARIC cohort)	11 years	Q5 (7.5 servings/d) vs. Q1 (1.5 servings/d)	RR Q5/1 fruit and vegetable intake: 0.94 (0.54 – 1.63)
⁹ (Dauchet <i>et al.</i> , 2004)	France and Northern Ireland	M: 5 years	Frequency of consumption of a standard portion of fruit, T3/1 ≥ 0.5 times/d vs. ≤ 0.07 times/d for citrus	RR T3 citrus fruit: 0.64 (0.41-0.99)* for CHD events.

Author and year	Population	Follow-up	Notes	Association (95% CI)
			fruit.	
¹⁰ (Genkinger <i>et al.</i> , 2004)	Odyssey cohort, Washington County, Maryland	13 years	Q5/1, 4.89 servings/d vs. 0.87 servings/d. Fruit and vegetable intake included sweet potatoes and yams.	HR Q5/1: 0.76 (0.54, 1.06)§
¹¹ (Hung <i>et al.</i> , 2004)	Nurses Health and Health Professionals Follow-up, USA	F: 14 years M: 12 years	Total fruit and vegetable intake (not including potatoes).	Five servings fruit and vegetable daily RR: 0.88 (0.81-0.95) One serving of green leafy vegetables daily RR: 0.95 (0.92-0.99)
¹² (Tucker <i>et al.</i> , 2005)	Baltimore Longitudinal Study of Aging (BLSA)	M: 18 years	High fruit and vegetables ≥ 5 servings/d; high SF > 12%, low SF ≤ 12%. Reference group: < 5 servings/d fruit and vegetables, high SF	High fruit and vegetables and high SF HR: 0.33 (0.15—0.71)† for CHD mortality; high fruit and vegetables and low SF HR: 0.24 (0.11-0.52)‡ for CHD mortality

ARIC: Atherosclerosis Risk in Communities Study; CHD: coronary heart disease; CI: confidence interval; CVA: cerebrovascular disease; CVD: cardiovascular disease including both ischaemic heart disease and stroke; DM: diabetes mellitus; F: female; FFQ: food frequency questionnaire; HR: hazard ratio; IHD: ischaemic heart disease; M: male; NHANES: USA National Health and Nutrition Examination Study; NS: not stated; Q: quintile; Q5/1: quintile 5 vs. quintile 1; Qr: quartile; Qr4/1: quartile 4 vs. quartile 1; RCT: randomised controlled trial; RR: relative risk; SF: saturated fat, SMR: standardised mortality ratio; T: tertile; T3/1: tertile 3 vs. tertile 1.

† P<0.01; ‡ P<0.001; * P< 0.03; § P = 0.15

¹⁻¹² Study numbering

Of the remaining three studies not showing significant inverse associations with fruit and vegetable intake and stroke, Keli *et al.* (1996) had the longest follow-up of 15 years of 552 men aged 50 – 69 years. Vegetable intake (<153.2 g/day vs. ≥ 215.8 g/day) as well as fruit intake (<41 g/day vs. ≥ 99.8 g/day) were not significantly related to incidence of stroke. Using data from men and women from the Atherosclerosis Risk in Communities Study (ARIC) followed-up for 11 years, Steffen and co-workers also found no significant relation of stroke with fruit and vegetable intake (7.5 servings per day vs. 1.5 servings per day) (Steffen *et al.*, 2003). It is interesting to note that potatoes were included as fruit and vegetables in this study.

Bazzano (2005) concluded that taken as a whole, the data support the hypothesis that fruit and vegetable consumption may have a protective role in the development of IHD and stroke. Random-effects models were used to combine measures of association from 14 prospective studies producing a summary relative risk of 0.85 (95% CI, 0.80 – 0.90; P < 0.001) for IHD for persons in the highest category of fruit and vegetable intake compared with those in the lowest. The data from the 11 studies identified with regard to stroke demonstrated a summary relative risk of 0.80 and 95% CI of 0.67 – 0.94 (P = 0.005) for persons in the highest category of fruit and vegetable intake compared with those in the lowest. Due to the methodological differences of the studies compared, the above summary of relative risk measures should be interpreted with caution.

Since the review by Bazzano (2005), four additional prospective studies have been identified to date and are also depicted in Table 2.9 (studies 9 – 12). Hung *et al.* (2004) reported a significant inverse association of total fruit and vegetable intake with CVD (RR, 0.88; 95% CI, 0.81 – 0.95) for men and women combined. Of the food analysed, green leafy vegetables showed the strongest inverse association with CVD. Furthermore, Dauchet and colleagues reported a significant inverse association ($P < 0.03$) between citrus fruit consumption and acute coronary events in the upper tertile of citrus fruit distribution compared with the lower tertile. No significant association was seen with other fruit or vegetables (Dauchet *et al.*, 2004). In the Baltimore Longitudinal Study of Aging, the individual and combined effects of fruit and vegetable consumption and saturated fat intake were investigated among 501 initially healthy men over a mean follow-up of 18 years. It was found that men consuming the combination of ≥ 5 servings fruit and vegetables per day and $\leq 12\%$ energy from saturated fat were 76% less likely to die from CHD ($P < 0.001$), relative to those consuming <5 servings fruit and vegetables and $>12\%$ energy from saturated fat (Tucker *et al.*, 2005).

Contrary to the previously mentioned studies, Genkinger and colleagues found that fruit and vegetables did not significantly lower the risk of CVD mortality, thus producing a hazard ratio of 0.76 (95% CI, 0.54 – 1.06) with the p-trend = 0.15 of the top fifth of fruit and vegetable intake compared with the bottom fifth (Genkinger *et al.*, 2004). Three out of the four studies identified after the review by Bazzano (2005) support the conclusion drawn by the latter, consequently the body of newly identified studies supports the role of fruit and vegetable consumption in the prevention of CVDs.

As an overall conclusion, 24 prospective studies have been taken into consideration in this literature review. Of those, 14 found significant inverse associations of whole fruit and vegetable intake with CVDs. The remaining ten studies reported inverse associations with fruit and vegetables, which trended towards significance. The body of evidence, therefore, consistently illustrates the protective role of fruit and vegetables in the prevention of CVDs.

2.6 Fruit and vegetable intake and cancer

Reviews of the potential of fruit and vegetables to prevent cancer have been carried out recently. Two of the most relevant reviews were identified (WHO/FAO Expert Consultation, 2003; WCRF/AICR, 1997) and a brief overview of their findings is given in the following section.

2.6.1 Strength of the evidence

In 1997, an international panel of experts, jointly assigned by the World Cancer Research Fund and the American Institute for Cancer Research, published its report after four years of work (WCRF/AICR, 1997). A large database of over four thousand scientific papers, published in peer-reviewed journals, was created. The strength of the association between fruit and vegetables and cancer was rated on a transparent scale as convincing, probable, possible and insufficient. In drawing its conclusions, the panel also took mechanism of action, their plausibility as well as the existence of a dose-response effect into consideration.

A summary of their conclusions regarding the intake of fruit and vegetables and specific cancer sites, is illustrated in Table 2.10 and described below as summarised by WCRF/AICR (1997).

Table 2.10 Summary of overall grading of cancer-preventive effect of the consumption of fruit and vegetables (WCRF/AICR, 1997)

CANCER SITE	EVIDENCE			
	Convincing	Probable	Possible	Insufficient
Mouth and pharynx	•			
Larynx		•		
Oesophagus	•			
Lung	•			
Stomach	•			
Pancreas		•		
Liver ^a			•	
Colon, rectum ^a	•			
Breast		•		
Ovary			•	
Endometrium			•	
Cervix			•	
Prostate ^a			•	
Thyroid			•	
Kidney ^a			•	
Bladder		•		

^a evidence relating to the intake of vegetables only

Mouth and pharynx:

Evidence that diets high in fruit and vegetables decrease the risk of cancers of the mouth and pharynx is convincing. One cohort study in Japan found a decreased risk of cancer of the mouth and pharynx with greater intake of green and yellow vegetables. Thirteen out of 15 case-control studies have reported a statistically significant protective association for at least one vegetable and/or fruit category. The evidence is most consistent for carrots, citrus fruit and green vegetables. The evidence for cruciferous vegetables, however, is not as convincing.

Larynx:

A diet rich in fruit and vegetables probably decreases the risk of laryngeal cancer. No prospective cohort study has reported on the association of fruit and vegetables and cancer of the larynx. Results from nine case-control studies showed statistically significant protective associations of at least one category of vegetables and/or fruit. These studies were conducted in both developing and developed countries. Few data are available on any particular type of vegetable or fruit.

Oesophagus:

The evidence regarding fruit and vegetables and the risk of oesophageal cancer is convincing. A cohort study conducted in Japan has shown a protective association between green and yellow vegetable consumption and the risk of oesophageal cancers. Eighteen out of 22 case-control studies reported a statistically significant protective association for at least one vegetable and/or fruit category.

Lung:

The evidence that diets high in fruit and vegetables decrease the risk of lung cancer is convincing. Seven cohort and 17 case-control studies were almost entirely consistent regarding the protective association of fruit and vegetable consumption and cancer of the lung. The evidence is most abundant for green vegetables and carrots.

Stomach:

A diet high in fruit and vegetables, collectively and separately, convincingly decreases the risk of stomach cancer. Stomach cancer is the most studied cancer with regard to vegetable and fruit consumption. Lung cancer and stomach cancer are the two sites for which the most prospective data are available. Six prospective cohort studies and 32 case-control studies have focused on this site. Of the prospective and case-control studies, three and 27 studies respectively have shown a statistically significant decrease in the risk of stomach cancer for one or more vegetable and/or fruit item or group. Raw vegetables, allium vegetables and citrus fruit have particularly shown consistent protective effects. Any evidence not consistent with a protective effect relates almost entirely to salted and pickled vegetables.

Pancreas:

There is substantial evidence from epidemiological studies that diets high in fruit and vegetables probably have a protective effect on cancer of the pancreas. Thirteen epidemiological studies have been identified investigating the relationship between fruit and vegetable consumption and risk of pancreatic cancer. Of the available evidence, nine out of ten case-control studies showed statistically significant protective associations of one or more vegetable and/or fruit item, while the results of three prospective studies showed neither significant increased nor decreased risk. There is, however, considerable variation in the specific foods showing protective relationships with pancreatic cancer.

Colon, rectum:

Evidence that diets rich in vegetables protect against cancers of the colon and rectum is convincing. For fruit, however, the data are more limited and inconsistent; as a result no judgment is possible.

Breast:

Diets rich in fruit and vegetables probably decrease the risk of breast cancer. A large amount of evidence regarding the link between fruit and vegetable intake and the risk of breast cancer were identified. Almost all of the data from epidemiological studies show either decreased risk with higher intakes or no relationship. The evidence is more abundant and consistent for vegetables (in particular green vegetables) than for fruit.

Bladder:

The evidence that a diet rich in fruit and vegetables decreases the risk of bladder cancer is probable. Fourteen individual-level epidemiological studies which investigated the above mentioned relationship were identified. Almost all of the studies reported either a decreased risk or no relationship with higher consumption for a variety of specific vegetable and/or fruit categories. The evidence was most abundant for fruit, green vegetables and carrots.

Liver, ovary, endometrium, cervix, prostate, thyroid, kidney:

The evidence regarding the relationship between fruit and vegetable consumption and the risk of cancer of respectively the liver, prostate and kidney suggests that diets high in vegetables possibly decrease the risk of cancer of the mentioned sites. Evidence relating to fruit consumption and respectively renal, prostate and liver cancer is limited; thus no judgment was possible.

Diets high in fruit and vegetables possibly decrease the risk of cancer of the ovary, endometrium, cervix and thyroid.

More recently, a joint WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases published its report with the primary purpose to examine and develop recommendations for diet and nutrition in the prevention of chronic diseases (WHO/FAO Expert Consultation, 2003). A summary of the section regarding fruit and vegetables and cancer is briefly described in the following paragraphs.

As summarised by the WHO/FAO Expert Consultation (2003), the strength of the evidence regarding the protective effect of fruit and vegetable intake and risk of certain cancers suggests that fruit and vegetables probably decrease the risk of cancer of the oral cavity, oesophagus, stomach and colorectum. For colorectal cancer, it was reported that a protective effect of fruit and vegetables has been suggested by many case-control studies, but that it has not been supported by results of several large prospective studies, suggesting that if a benefit exists, it is likely to be modest.

As one of the outcomes of the report, to include at least 400 g/day of total fruit and vegetables in the diet was one of the main disease-specific recommendations for reducing the risk of developing cancer (WHO/FAO Expert Consultation, 2003).

In conclusion, the body of evidence strongly suggests that the consumption of fruit and vegetables may have a protective effect in the development of certain cancers.

2.7 Conclusion

In conclusion with regard to the definition of fruit and vegetables, relevant to use in South Africa, it is recommended that vegetables should include edible parts of plants commonly considered as vegetables as well as botanical fruit used as vegetables (e.g. tomatoes and peppers). Roots and tubers should also be considered as vegetables, but not dry pulses. The frozen and dried counterparts of the above should be eligible to be classified as vegetables.

Fruit should include all fresh fruit as well as fruit with high energy-density such as avocados. It is recommended that 100% unsweetened fruit juices, frozen and dried fruit should also be included.

A standard portion of fruit and vegetables is most often considered as 80 g. The actual portion sizes which are consumed can, however, be smaller or larger, depending on the food. The average consumption of 80 g portions is thus more acceptable when a variety of fruit and vegetables are consumed.

The body of evidence reviewed in this literature study supports the role of fruit and vegetable consumption in the prevention of diabetes, CVDs and certain cancers. The evidence regarding fruit and vegetable intake and management of body weight are, however, inconclusive.

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CHAPTER 3

3 A STRATEGIC FRAMEWORK FOR PROMOTING FRUIT AND VEGETABLE CONSUMPTION IN SOUTH AFRICA

As stressed in Chapter 1, the development of a framework for promoting fruit and vegetable intake in South Africa is of utmost importance. For the purpose of developing a national framework, the global framework produced at the joint FAO/WHO Workshop - Fruit and vegetables for health, 1-3 September 2004, Kobe, Japan (FAO/WHO, 2005) - was used as guiding document.

As schematically presented in Figure 3.1, the **guiding principles** which a national fruit and vegetable programme should adhere to are first of all stated, followed by the **categorisation of the consumer domains** with regard to how fruit and vegetables are procured and consumed and their relevant supply networks together with certain entry points and barriers to consumption specific to the identified consumer domains. **Stakeholders were identified** out of which a coordinating team should ideally be assigned to drive the process described in this chapter. Furthermore, **existing national goals, objectives and policies** are recognised with regard to the theme of fruit and vegetables. **Possible interventions** to increase the consumption of fruit and vegetables in South Africa are suggested and the importance of monitoring and evaluating these interventions/programmes are stressed.

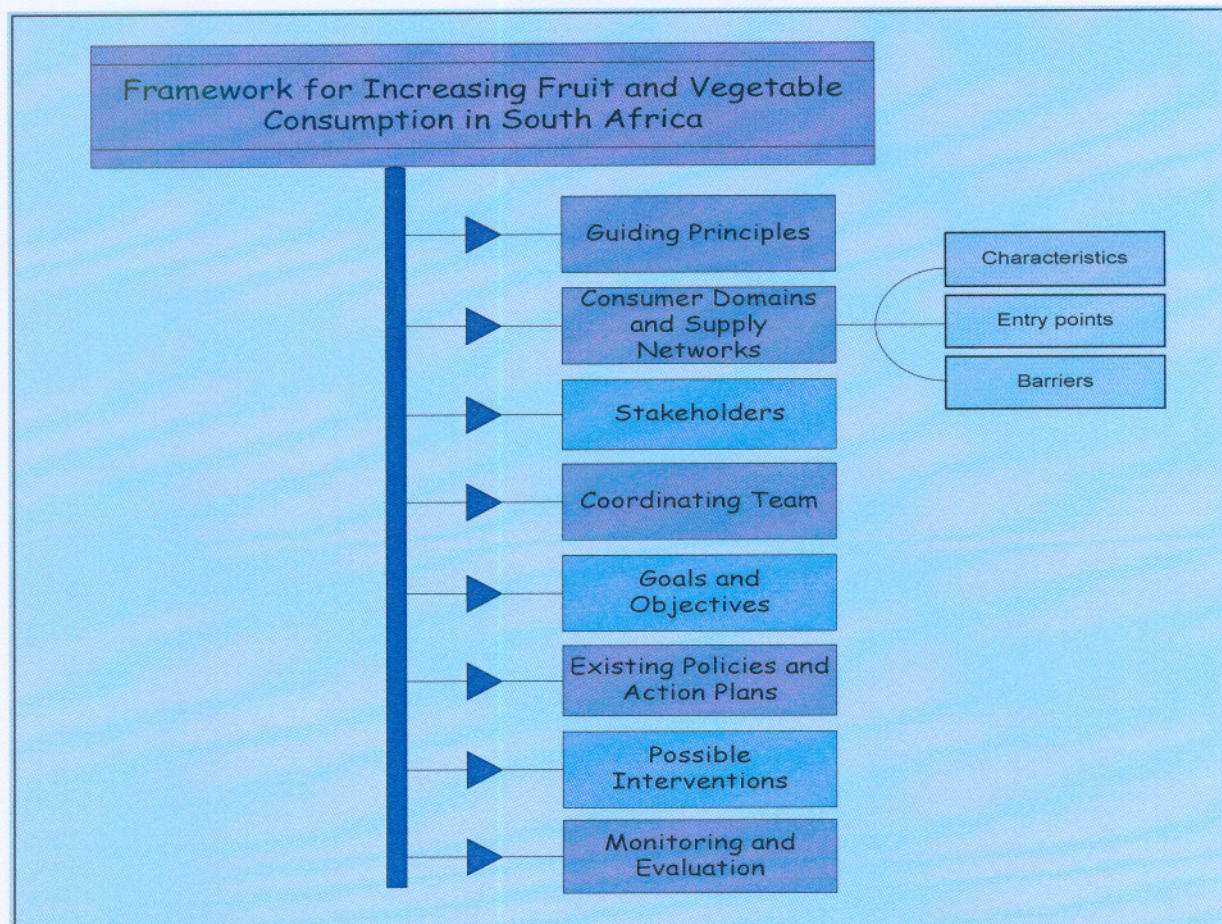


Figure 3.1 Structure of the framework to increase fruit and vegetable consumption in South Africa

3.1 Guiding principles for programmes

The right to nutritious food and the will to end hunger and ensure food security has been affirmed globally at several occasions. Article 25 (1) of the Universal Declaration of Human Rights, adopted and proclaimed by the United Nations (UN) General Assembly in December 1948, states: *"Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food [...]"* (Universal Declaration of Human Rights, 1948). In 1992, Ministers and the Plenipotentiaries present at the International Conference on Nutrition, declared: *"We recognize that access to nutritionally adequate and safe food is a right of each individual"* (International Conference on Nutrition, 1992).

The World Food Summit Plan of Action of 1996 particularly refers to the production of fruit and vegetables under paragraph 21, objective 2.3 (c) by calling on governments, in partnership with all actors of civil society, to *"encourage, where appropriate, the production and use of culturally appropriate, traditional and underutilized food crops, including grains, oilseeds, pulses, root crops, fruit and vegetables, promoting home and where appropriate, school gardens and urban agriculture, using sustainable technologies [...]"* (World Food Summit, 1996). Then in 2002, the Declaration of the World Food Summit: five years later, reaffirmed *"the right of everyone to have access to safe and nutritious food"*. It emphasises in paragraph 14 *"the need for nutritionally adequate and safe food and highlight the need for attention to nutritional issues as an integral part of addressing food security"* (World Food Summit: five years later, 2002).

Target 2 of the Millennium Development Goals, compiled by UN members in 2000 states: *"Halve, between 1990 and 2015, the proportion of people who suffer from hunger"*, and goes hand in hand with fruit and vegetable promotion. The following targets of the Millennium Development Goals also complement the initiative to increase fruit and vegetable consumption worldwide:

- Target 5: "Reduce by two thirds, between 1990 and 2015, the under-five mortality rate";
- Target 6: "Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio";
- Target 8: "Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases" (Millennium Development Goals, 2000).

Because South Africa has been a member of the UN since 7 November 1945 and formed part of the process of developing the goals mentioned above, it therefore undersigns and accepts it.

The general principles of a national project to promote fruit and vegetables in South Africa have mainly been adopted from the FAO/WHO (2005) and should include the following:

- Availability (fruit and vegetables should be readily available)
- Accessibility (all persons of the target group should have access to fruit and vegetables)
- Affordability (fruit and vegetables should be affordable)
- Acceptability (with regard to quality, taste, safety, type of food, cultural sensitivity)
- Equitability (including underprivileged)
- Sustainability (the goal of the project for example increasing production of green leafy vegetables should be able to be maintained by target group even after the intervention)

- Holistic or integrative approach needs to be taken when planning projects
- Marketing/creating awareness of fruit and vegetables in foods and food programmes.

Based on the framework developed by the FAO/WHO (2005), a coordinated fruit and vegetable promotion programme should :

- Include initiatives that target both demand and supply side issues and should be based on a thorough needs assessment
- Be in line with and complementary to already existing national policies, action plans and strategies from *inter alia* the agricultural, health (food and nutrition) and environmental sectors
- Be socially inclusive and target all social classes, particularly the poor and disadvantaged
- Be participatory and involve the community so that transfer of ownership of projects can take place
- Be consistent with messages across policies and programmes. Every programme or project should promote a healthy diet with inclusion of at least five fruit and vegetables a day (special emphasis being placed on the promotion of increased fruit and vegetable intake as part of the provision of the Primary School Nutrition Programme (PSNP) and welfare food programmes)
- Have an increased fruit and vegetable consumption of the target group(s) as outcome
- Have an approach/principle which is holistic, multisectoral, integrated and multidisciplinary
- Attempt to mobilise existing resources such as people, land, information, policies and initiatives
- The process and all interventions should be evaluated and monitored
- Ensure that best practices prevail.

3.2 Fruit and vegetable consumer domains and supply networks

An important issue in the design of intervention strategies is that different types of consumers acquire, prepare and consume fruit and vegetables in different ways. There are also different types of producers and suppliers according to the consumer domains. In order to design effective interventions to improve fruit and vegetable intake, it is essential to characterise the different consumer domains, identify the under-consuming population and make efforts to understand their consumption behaviours.

The categorisation of fruit and vegetable consumers into the four domains as contained in the report of FAO/WHO (2005) is adhered to:

a) Rural small-holders producing fruit and vegetables for own consumption and market supply

Small-holder subsistence farmers who mainly produce fruit and vegetables for own consumption and possibly for a local market.

b) Market-dependent consumers

These consumers are totally dependent on markets to procure fruit and vegetables and are mainly situated in urban and peri-urban areas.

c) Mixed consumers

Rural and particularly urban gardeners who produce some fruit and vegetables for own consumption, but who are also dependent on market supply.

d) Institutional consumers

Consumers for whom fruit and vegetables are purchased and prepared by others. These include consumers at schools, worksites, hospital/care facilities, the military and prisons.

The following points are not meant to be exhaustive, but are an attempt to characterise the different consumer domains and their supply networks and further identify possible entry points for strategies and actions for the specific consumer domain and related supply network assigned to it. Furthermore, potential barriers to fruit and vegetable intake that are general as well as specific to the respective consumer domains are identified.

South African data with regard to the characteristics, supply networks and barriers of the consumer domains was incorporated where available. The data that is unreferenced is either extrapolated from the report of FAO/WHO (2005) or obtained from personal observation. When planning interventions, it is necessary to select the relevant characteristics of the consumer domains and their corresponding supply networks and barriers to consumption of fruit and vegetables that comply with the specific population within the targeted consumer domain where fruit and vegetable intake wants to be augmented.

3.2.1 Characteristics of fruit and vegetable consumer domains and supply networks

Fruit and vegetables are procured in varying amounts and from various supply sources. These may include purchasing from local, rural markets or supermarkets in urban centers right through to own production.

The specific characteristics of consumer domains and their supply networks mentioned above are summarised below.

a) Characteristics of rural small-holders producing fruit and vegetables for own consumption and market supply

- Maize meal is the main staple food. Most frequently consumed vegetable is *morogo* (wild spinach) (Steyn *et al.*, 2001; Vorster *et al.*, 1994) and pumpkin (Faber *et al.*, 1999). Most popular fruit is banana (Faber *et al.*, 2002; Faber & Benade, 1999; Steyn *et al.*, 2000; Vorster *et al.*, 1994). Peanuts are frequently added to vegetables (Steyn *et al.*, 2000; Vorster, 1994)
- A very limited variety of fruit and vegetables may be prominent
- Most of the fruit and vegetables eaten are from own production
- Exchange of fruit and vegetables for other goods may take place
- They often make use of indigenous vegetables
- Most of better quality fruit and vegetables are taken to the market to sell

- May have difficulty with irrigation, seed acquisition, transport, pesticide use and post-harvest handling
- Many have limited/no storage facilities
- Men produce cash crops, women produce fruit and vegetables for own consumption around the house or in a small garden
- Surplus green leafy vegetables from summer months are usually dried for use during winter (Steyn *et al.*, 2001).

As an example of this domain, the situation of the Venda region farmers is described below (Leroy *et al.*, 2001):

- Most of the farmers are men
- Crops are mainly grown for household consumption
- Limited tools are available
- Private land ownership is not allowed; farmers only receive "permission to occupy" from the tribal chief
- Income from agriculture are relatively small.

Supply networks

Very small quantities of surpluses generated are sold. Crops are sold mainly on the local market; some farmers sell crops (e.g. tomatoes) to the processing industry (Leroy *et al.*, 2001).

b) Characteristics of market-dependent consumers

- Black urban dwellers are reported to eat vegetables and fruit in small amounts, usually one small portion twice a day, with women consuming notably more vegetables and fruit than men (Mackeown *et al.*, 2005; UNISA, 1994; Vorster *et al.*, 2005; Walker, 1996)
- Qualitative descriptions have indicated that Indian and white urban dwellers eat vegetables in small amounts at the two main meals and it may be prepared with oil, margarine, butter or other types of cooking fat. A variety of fresh, frozen and canned vegetables as well as fresh fruit and fruit juices are eaten, but in small amounts, about 2 – 3 times a week (Bourne *et al.*, 1994; Langenhoven *et al.*, 1995; Mackeown *et al.*, 2005; Richardson & Cleaton-Jones, 1986; UNISA, 1994; Walker, 1996)
- People living in informal settlements which may fall under this consumer group have little/no running water, no proper sanitation and the hygienic conditions are very poor (Walker, 1996)
- These consumers are cash dependent, since they have limited ability to grow food, with most of them living in urban or peri-urban areas
- Many women work outside the home; hence there is less time available for food preparation and a greater need for convenience and processed foods
- Poor consumers in this group often purchase in small amounts because of a lack of cash availability and/or proper storing facilities (e.g. refrigerators) and can, therefore, not benefit from supermarkets offering bulk purchases at reduced costs
- Especially the youth in this group might be very image conscious; impacting on what is considered trendy to eat

- These consumers may not have access to conditional transfers, social safety nets or food aid programmes
- In some cases, for instance in peri-urban areas, consumers stay far from fruit and vegetable retailers and may experience transport problems
- Mostly in urban areas, fruit and vegetables can be bought from street vendors.

Supply networks

The supply network of the market-dependent consumer is that typical of urban and peri-urban areas. The majority of suppliers are specialised growers in rural or peri-urban areas with a source of water, selling to processors and retailers either directly or through assembly or wholesale markets, or sometimes directly to consumers through farmers' markets. Small-scale emerging farmers are, however, also a significant part of this supply chain. As an example, characteristics of mango farmers in Venda are given below (D'Haese *et al.*, 1998):

- Make use of intercropping system
- Most farmers have invested in some form of irrigation ranging from flood to drip irrigation
- Mostly produce cash crops
- Make use of low quality cultivars
- Well informed on use of fertilisers.

The wholesale/retail chain, especially where supermarkets and specialised greengrocers are involved, may be characterised by cold chains and transport of produce over distances, depending on the region concerned. Import-export of exotic and out-of-season commodities is another feature of the supply chain corresponding with the market-dependent consumer. At the retail end of the supply chain there may be a range of formal, well-organised operations like supermarkets, small greengrocer shops and informal street and roadside stalls (e.g. *spaza* shops). Processed, semi-processed and pre-packaged fruit and vegetables can be a very significant proportion of this kind of supply network, as can street food. Where there are formal market supply chains, they are subject to food safety and health regulations.

c) Characteristics of mixed consumers

- These consumers are occasional fruit and vegetable producers
- If fruit and vegetables are produced, they are normally grown locally in either a home garden or community garden (Faber *et al.*, 1999)
- The produce they grow is limited in range and amount
- The trade of fruit and vegetables with neighbours are a common phenomenon
- They often belong to low to mid-income level classes
- Fruit and vegetables are purchased from local stores (Faber *et al.*, 1999)
- This group may have limited knowledge of the nutritional value of fruit and vegetables and/or have cultural bias against fruit and vegetables

- In some instances low intake of fruit and vegetables has been shown, despite the presence of home gardens (Faber *et al.*, 1999)
- As shown by Schmidt and Vorster (1995), there was no significant difference between vegetable intake and nutritional status of households who grew their own vegetables in a communal garden compared with those who did not, in a village in the Kudumane district of the then Bophuthatswana. It was concluded that a vegetable garden covering 13 square metres (usual size of communal garden plots) can only produce 20% of the requirements of the average household
- Farm dwellers are according to Vorster *et al.* (2000) nutritionally the most vulnerable group, having inadequate diets.

Supply networks

The supply networks of the mixed consumer domain may correspond with that of the market-dependent consumer domain. However, the mixed consumers are typically supplied by small operators outside the organised formal supply networks. The suppliers are mostly urban/peri-urban growers selling fruit and vegetables directly through informal street markets, small-mixed grocery shops, *spaza* shops or stands selling a limited variety of seasonal vegetables and fruit acquired from wholesalers, producers or fresh produce markets. Fruit and vegetables may also be home-grown in small home gardens or community gardens or procured directly from the farmer (e.g. farm workers).

d) Characteristics of institutional consumers

Schools:

- Fruit and vegetables eaten at school are either procured through the PSNP (if implemented and/or if fruit and vegetables are on the menu) or through school lunches brought from home
- As an example, the nutritional status of black school children participating in a school feeding scheme in a private rural school in Midrand, Johannesburg was assessed. No fruit and vegetables were usually provided. The data indicated that 12% of the children were stunted or chronically malnourished and 6% of the children suffered from acute malnutrition (Reitsma *et al.*, 1994)
- Among primary school children, fruit and vegetables were found not to be one of the food preferences. The list of most disliked foods included cabbage (16%); *imfino* (a dark-green leafy vegetable) (12%) and pumpkin (8%) (Faber *et al.*, 1999)
- These consumers are normally peer-sensitive and image conscious, especially high school pupils
- They are very easily influenced by example advertisements and teachers, especially pre and primary school children
- Some children receive pocket money which they spend at tuck shops and/or vending machines at school
- Sometimes private companies provide food to schools for example Meals on Wheels/welfare organisations
- The lack of knowledge of hygienic practices might be common.

Worksites:

- Consumers are usually healthy adults
- Fruit and vegetables are either brought from home, bought outside the workplace at fast food outlets, restaurants or street vendors or bought on site at canteens or vending machines.

Hospitals/care facilities:

- These consumers include the elderly and children at care facilities for example crèches or orphans
- These consumers are usually people with health conditions who might have eating problems or limited food that can be handled; hence they are at high risk of malnutrition
- Fruit and vegetables eaten are through menu plans of the hospital, nursing home, crèche or orphanage
- In South Africa, the provision of balanced nutrition for persons in public institutions and to ensure that persons receive meals that are acceptable (including culturally acceptable) and adequate in quality and quantity are overseen by the Department of Health, Directorate Nutrition, through the Integrated Nutrition Programme (INP) under the category Food Service Management. Technical support for reaching the above is provided by dietitians (Department of Health, 2005)
- The meals provided by these institutions are likely to be inadequate as shown by Pietersen and co-workers who evaluated state-funded crèches in two areas of the Western Cape (Pietersen *et al.*, 2002).

Military:

- Consumers are normally young, healthy adults
- Fruit and vegetables are provided as part of set meals
- These consumers might also bring/receive parcels from home containing for example dried/canned fruit
- Fruit and vegetables might also be bought outside at cafeterias, food retailers, fast food outlets, etc.

Prisons:

- Consumers can be at risk of or vulnerable to malnutrition
- Fruit and vegetables eaten are dependent on the set menu of the institution.

Supply networks

The supply network corresponding to this consumer domain is similar to that of market-dependent consumers. The direct purchasing of fruit and vegetables from producers or wholesalers, however, may be more frequent especially where institutional use is large-scale, on a regular basis and long-established.

3.2.2 Entry points

In this section possible entry points for strategies and/or intervention programmes, for each consumer domain are listed. It represents possible angles where fruit and vegetable interventions/programmes can be initiated. Together with the listed entry points, broad ideas of the type of interventions which could be considered according to the entry points are given.

a) Entry points of rural small-holders producing fruit and vegetables for own consumption and market supply

- *Infrastructure*: improve infrastructure for example irrigation systems
- *Farmers*: educate farmers on best pesticide practices; simple technologies for production (e.g. intercropping system); conservation of resources; post-harvest handling, etc.
- *Women*: empowering women by educating them on establishing home gardens, because they have a big influence on what their family consume
- *Local markets*: provide education on production techniques, food safety and health benefits.

b) Entry points of market-dependent consumers

- *Own production*: promote fruit and vegetable growing, for example micro-gardening or community gardens (especially informal settlements or villages)
- *Local markets, supermarkets, small and large retailers*: provide information on health benefits of fruit and vegetables as well as preparation methods, etc. to consumers
- *Food service industry*: healthier food options with inclusion of vegetables and fruit in dishes.

c) Entry points of mixed consumers

- *Own production and/or trade with neighbours*: provide education on simple production techniques/crop diversification, food safety, preparation and health benefits of fruit and vegetables
- *Local markets*: improve infrastructure of market, provide education on simple production techniques/crop diversification, food safety, preparation and health benefits of fruit and vegetables for consumers, improve post-harvest handling
- *Supermarkets/retailers*: provide education on health benefits of fruit and vegetables to consumers.

d) Entry points of institutional consumers

Schools:

- *School curriculum*: re-examining of school curriculums eg. including nutrition in science classes, home economics, etc., hence educating schoolchildren on *inter alia* what a healthy diet is, the health benefits and preparation methods of fruit and vegetables
- *Parent-teacher associations*: education and instruction of parents and teachers through curriculum and parent-teacher associations
- *School environment*: create a clean environment by encouraging food washing, proper hand washing and basic hygienic practices

- *Production of fruit and vegetables*: producing fruit and vegetables parallel with the education on the health benefits, etc. thereof via school gardening programmes
- *PSNP*: specify percentage compulsory inclusion of fruit and vegetables in menu
- *School tuck shops and vending machines*: identify food items to be included and excluded from school environment
- *Media/advertising*: use of posters, talks by popular role models, etc. as visible reminders.

Worksites:

- *Heads of companies*: fruit at work for example Danish workplace fruit programme (6 om dagen, 2001)
- *Vending machines and canteens on site*: changing available food choices to include fruit and vegetables (dried, canned, fresh, unsweetened 100% juices)
- *Worksite programmes*: increase nutritional awareness of workers and increase education of management that nutrition is important for healthy workers and productivity
- *Environment*: creating a clean environment with the provision of minimum kitchen facilities for preparation of foods for example microwave or heating implement, sink for washing, refrigeration
- *Advertising material*: reminders such as posters, educational materials audio programmes, seminars, provision of recipes for healthy foods, interactive website
- *Labeling*: enforce labeling of purchasable foods in the worksite
- *Restaurants/fast food outlets near workplace*: provide healthier food choices, display healthy diet posters, nutritional information of available foods and advertising of healthier food choices.

Hospitals/Care facilities:

- *Prescribed menus*: inclusion of fruit and vegetables in menus at hospitals and nursing homes
- *Staff at crèches*: training of staff with regard to basic nutrition principles, menu planning and food budgeting (Pietersen *et al.*, 2002).

Military:

- *Dietician of the military*: inclusion of fruit and vegetables in daily menus
- *Posters/educational material*: material can be provided on healthy diets, healthy benefits of fruit and vegetables, etc.
- *Awareness campaigns*: fruit and vegetables (dried and canned) can be bought or brought from home and stored easily for snacking.

Prison:

- *Menus*: inclusion of fruit and vegetables in daily meals provided.

3.2.3 Barriers to fruit and vegetable consumption and/or promotion

General as well as specific barriers relevant to South African consumers and producers have been identified and are described below.

3.2.3.1 General barriers

Economic issues:

- Limited disposable income and, therefore, finding it difficult to incorporate the South African Food-Based Dietary Guideline for fruit and vegetables (Love *et al.*, 2001) and price of produce (affordability at a local and individual level) (Love *et al.*, 2001; Peltzer & Promtussananon, 2004)
- Large families, illiteracy and unemployment.

Lack of knowledge:

- Nutritional knowledge is very poor, particularly with respect to the concept that deals with safety aspects of food (Steyn *et al.*, 2000), preparation of fruit and vegetables, what constitutes a balanced diet (as income increases or urbanisation takes place, hence increasing meat/fat consumption) and the hygienic practices related to fruit and vegetables
- Lack of knowledge of farmers with regard to management practices
- Perception or communication of food safety risk - chemical or microbiological contamination.

Competing priorities:

- Competing government priorities (e.g. HIV/AIDS awareness campaigns, policies promoting cereal production on arable land and with available irrigation water)
- Competition for funding with other promotion programmes and with more popular foods.

Infrastructure:

- Lack of infrastructure (Faber *et al.*, 2002), goats and insects destroying the vegetables (Faber *et al.*, 2001) and destruction of unfenced or poorly fenced gardens (Faber & Benade, 2003), therefore, limiting implementation and promotion of sustainable gardening programmes
- Lack of clean, safe water, municipal and health services, sanitation systems and electricity
- Perishability of fruit and vegetables parallel with lack of storing facilities for example refrigerators.

Climate:

- Seasonality, water availability, extremes of heat, cold, drought, rain
- Availability – highly contingent on seasonal fluctuations (Love *et al.*, 2001) and adequacy of marketing facilities.

Cultural barriers:

- Traditional diets (can be both barrier and facilitating factor), cultural misperceptions affecting dietary preferences (e.g. fruit causes diarrhea and/or fruit and vegetables must only be eaten over weekends).

Household issues:

- Household taste preferences – most resistance to fruit and vegetable consumption comes from the children and, in some cases, the men in the household (Love *et al.*, 2001)
- Time and effort it takes preparing especially vegetables (Peltzer & Promtussananon, 2004)

- Eating out frequently (Peltzer & Promtussananon, 2004). Introduction or rapid increase of fast food culture - ready to eat fruit and vegetables are not easily available, however, ready to eat fast food is.

Media related issues:

- Confusing fruit and vegetable consumption recommendations (Peltzer & Promtussananon, 2004). Misperception of advertised health claims of other products (functional foods) and distortion of information by mass media
- Media advertising sweets, pastries, etc. and then demanded especially by children.

Acceptability:

- Social acceptability of fruit and vegetable promotion interventions.

Production:

- Negative experiences with overproduction, necessitating strategies for diversification, better scheduling, value chain efficiency enhancement and/or production shift
- Lack of horticulture technology.

3.2.3.2 Specific barriers according to consumer domains

a) Barriers of rural small-holders producing fruit and vegetables for own consumption and market supply

- Lack of infrastructure for example irrigation systems
- Extreme poverty of producers and consumers
- Limited and low quality varieties of crops (no crop improvement)
- Lack of human resources
- Lack of funding/cash flow
- Limited/no storage facilities
- Inadequate marketing facilities.

Example of the barriers experienced by Venda region farms (Leroy *et al.*, 2001):

- Decreased land quality
- Lack of management skills.

b) Barriers of market-dependent consumers

- Fear of pesticide poisoning
- Rapidly growing fast food culture
- Accessibility - lack of transport to fruit and vegetable retailers
- Retail price of fruit and vegetables
- Change in employment and lifestyles with urbanisation - lack of time for the preparation and cooking of food as urbanisation increases and more women work outside the home.

c) Barriers of mixed consumers

- Inadequate marketing facilities
- Lack of appropriate technology

- Insufficient land
- Low income
- Lack of knowledge of pesticide use, production techniques and health benefits of fruit and vegetables
- Limited water supply which is clean and safe.

d) Barriers of institutional consumers

- Vending machines, tuck shops, canteens offering “popular” foods which are usually unhealthy
- At schools with fruit and vegetable gardens, children eat the produce before it has matured
- Some of the foods selected by the PSNP may negate nutrition education and healthy eating habits (McCoy *et al.*, 1997)
- Government funding for the PSNP is very little and may not reach all school children at risk of malnutrition
- Acceptability and feasibility of promotional programmes
- Interests of the institutional food provider competing with fruit and vegetable promotion.

In conclusion, it is clearly seen that the consumer domains as categorised earlier, have vast characteristics. It may vary even between populations and areas in South Africa and it is thus necessary to select the relevant characteristics complying with the targeted population when planning interventions. The same principle also applies to the barriers to the consumption of fruit and vegetables. For example, a specific barrier that might be experienced by a certain population of the market-dependent consumers, might not apply to another.

3.3 Identification of stakeholders and coordinating team

Possible stakeholders were identified that are involved in reaching the goal of increasing the fruit and vegetable intake of South Africans. These stakeholders are primarily categorised into the following sectors: (i) the public sector, (ii) private sector, (iii) non-governmental organisations and (iv) international stakeholders. They are further described with regard to the reason why they are considered as stakeholders as well as the area where they would have the greatest impact. The rationale for inclusion of the identified stakeholders are either through information obtained from relevant spokespersons, objectives as set out by the stakeholder or personal reasoning. An illustration of the structure of the categorisation of the stakeholders is given in Figure 3.2. The possible stakeholders involved in the promotion of fruit and vegetables as well as the increase in supply and demand of fruit and vegetables in South Africa are listed in Tables 3.1 – 3.4.

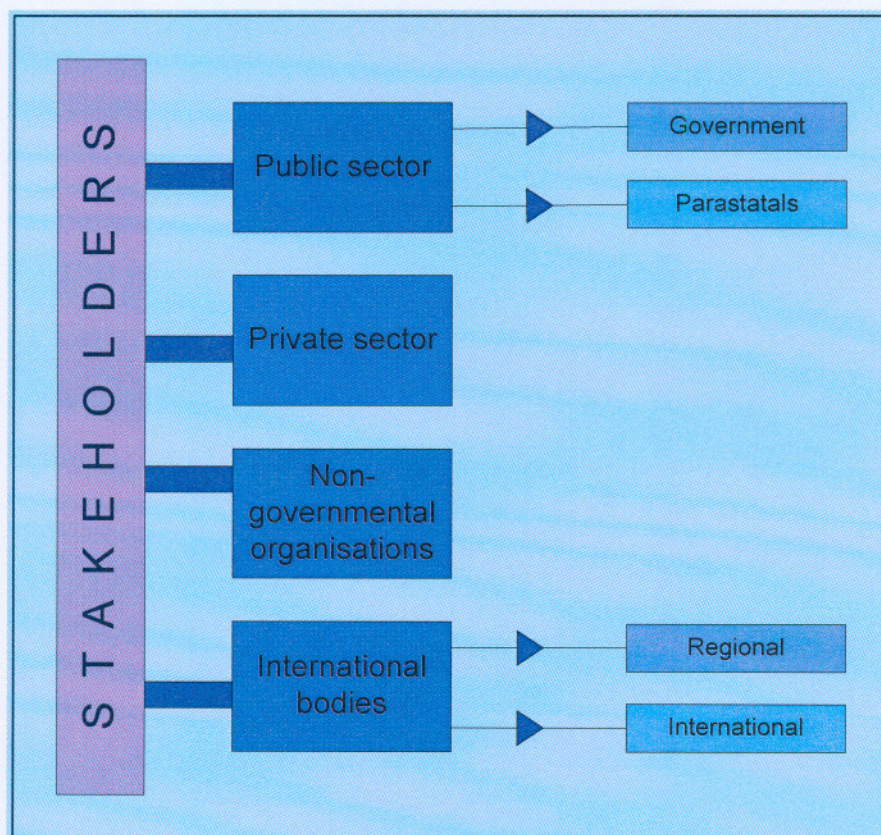


Figure 3.2 Structure of the categorisation of stakeholders involved in fruit and vegetable promotion

Table 3.1 Possible stakeholders of fruit and vegetable promotion in the public sector in South Africa

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
GOVERNMENT		
DEPARTMENT OF HEALTH		
Corporate Services Cluster: Communication Unit	- To promote the consumption of fruit and vegetables through the supply of information to the mass media and the public - To inform health sector stakeholders about national health policies, strategies, programmes and legislation considering fruit and vegetables and to develop interaction with such stakeholders - Design of educational and promotional materials in support of programmes of other units - Dissemination of information to governmental and non-governmental stakeholders	Fruit and vegetable consumers and non-consumers; different government departments; health sector
Strategic Health Programmes Cluster: Maternal Child and Women's Health and Nutrition		
Directorate Nutrition	Promoting nutrition educational activities through the Integrated Nutrition Programme	Mostly women and children
Directorate Child and Youth Health	Working closely with Directorate Health Promotion	Rural and urban children (mostly through schools)
Cluster: Pharmaceutical Policy and Planning		
Directorate Food Control	Inform, educate and communicate food safety to stakeholders, industry, consumers, etc.	Rural and urban fruit and vegetable consumers
Health Service Delivery Cluster: Health Information, Research and Evaluation		
Directorate Health Systems Research, Research Coordination and Epidemiology	- Responsible mainly for the coordination of the research agenda for the country by taking a leadership role in establishing and setting guidelines for research ethics and priority setting - Responsible for maintaining public health surveillance systems	Fruit and vegetable consumers and non-consumers
Cluster: Health Services		
Directorate Hospital Management	Inclusion of fruit and vegetables in daily menus of patients in hospitals	Patients in hospitals

^a Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.1 Continued

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
Cluster: PHC, Districts and Development		
Directorate Health Promotion	• Organising the establishment of food gardens • Promoting good nutrition with the Healthy Lifestyle Campaign by: ◦ Giving nutrition education in the community ◦ Promotional events promoting fruit and vegetables	Rural and urban fruit and vegetable consumers and non-consumers; children; farmers ^a ; community
Cluster: Noncommunicable Diseases		
Directorate Chronic Diseases, Disabilities and Geriatrics	The development of national policy guidelines for: • Management and control of chronic diseases	People suffering from chronic diseases
Directorate Forensic Laboratory Services	• Analysis of food samples for pesticides and other agricultural chemical residues, to ensure compliance with local regulations	Small and large-scale rural and urban farmers; fruit and vegetable consumers
DEPARTMENT OF AGRICULTURE		
	Lead and support sustainable agricultural and rural development through: • Ensuring access to sufficient and safe fruit and vegetables • Maximising growth, empowerment and income in the agriculture sector • Enhancing the sustainable management of natural agricultural resources and ecological systems • Ensuring efficient and effective governance • Ensuring knowledge and information management	Rural and urban fruit and vegetable consumers; farmers
Directorate Food Security and Rural Development	• Policy analysis and development • Support and coordinate the implementation of special food security programmes • Involved in rural development • Providing information on the most vulnerable groups with regard to food security	The food insecure population

^a Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.1 Continued

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
Directorate Plant Health and Quality	• The standardisation, publication and regulation of norms for certain agricultural and related products • The promotion and provision of propagation material of superior quality • The prevention of agricultural pests and diseases being imported or distributed • The analysis of certain agricultural products to ensure compliance with prescribed standards on local and foreign markets	Small and large-scale rural and urban farmers; fruit and vegetable consumers
Directorate Plant Production Systems	• Ensure the production of good quality produce • Ensure the production of good and efficient variety of produce • Support emerging farmers through dissemination of information regarding production techniques, etc. through websites and printed brochures handed out by extension officers • Support research activities regarding fruit and vegetable production together with the Agricultural Research Council • Implementing programmes to promote indigenous vegetables as well as the commercialisation thereof	Farmers (small and large-scale)
Directorate Business and Entrepreneurial Development	• Needs analysis of skills and previous training of emerging farmers • Skills development of emerging farmers (e.g. fertiliser use) • Training with regard to business planning (e.g. pre-planning)	Small-scale emerging farmers
Directorate Sustainable Resources Management and Use	• Improvement of irrigation systems, especially to rural and peri-urban areas • Management of water use • Management of land use for agricultural purposes	Farmers (small and large-scale); people in rural and peri-urban areas struggling to establish vegetable gardens

^a Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.1 Continued

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
DEPARTMENT OF EDUCATION		
Directorate Nutrition	• To provide nutrition in education, hence increasing knowledge of fruit and vegetable intake of children • To determine the impact of nutrition on education • To promote nutrition through gardening in schools and surrounding communities • To administer the school feeding programme	Children in rural and urban schools and the surrounding community
Directorate School Education	• To manage the development, evaluation and maintenance of policy, programmes and systems for school education	Children in schools in South Africa
Directorate Higher Education	• Providing scientific leadership in the area of fruit and vegetables	Fruit and vegetable consumers; farmers
DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM		
Branches: Environmental quality and protection Biodiversity and conservation	• Promote a global sustainable development agenda • Lead sustainable development of the environment • Promote and conserve the biological diversity and cultural and local natural resources and ensure the sustainable utilisation of resources for the benefit of the people of South Africa • Protect the environment in the interest of the health and well-being of the people of South Africa • Provide environmental information in support of effective environmental management and public participation • To provide programme management support service to Line Managers in managing Poverty Relief projects	Environment - natural resources
DEPARTMENT OF LABOUR		
	• Included because of possible fruit and vegetable worksite programmes • Possibility of worksite hazards	Persons employed by any body or authority

^a Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.1 Continued

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
DEPARTMENT OF SOCIAL DEVELOPMENT		
	- Through the Integrated Poverty Eradication Strategy provide direct benefits to those in greatest need, especially women, youth and children in rural areas and informal settlements - Development of a comprehensive social security system and prioritise the most vulnerable households	Poor, vulnerable and excluded people in society
DEPARTMENT OF LAND AFFAIRS		
Directorate Land Reform Directorate Land Tenure Reform Implementation Systems	Provide access to land and extend tenure rights to the disadvantaged communities/individuals	Disadvantaged communities and individuals
Directorate Redistribution Implementation Systems	To develop efficient product, systems and procedures for: - A more equitable distribution of land - Addressing the problem of landlessness - Enhancing household income security, employment and growth throughout the country	Farmers - especially small-scale and those without land
Directorate Restitution	- To promote equity for victims of dispossession by the state, particularly the landless and the rural poor - To facilitate development initiatives by bringing together all stakeholders relevant to land claims - To promote reconciliation through the restitution process - To contribute towards an equitable redistribution of land rights	Rural poor; persons without land to farm on
DEPARTMENT OF PUBLIC WORKS		
	Infrastructure development	Rural fruit and vegetable consumers and non consumers

^a Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.1 Continued

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
DEPARTMENT OF SCIENCE AND TECHNOLOGY		
	Introducing measures that put science and technology to work to make an impact on growth and development in a sustainable manner in the area of fruit and vegetable production and processing	Entrepreneurs in the area of fruit and vegetable production and processing
DEPARTMENT OF WATER AFFAIRS AND FORESTRY		
	- To ensure that all South Africans gain access to clean water and safe sanitation - Promote effective and efficient water resources management to ensure sustainable economic and social development	Rural and peri-urban fruit and vegetable consumers and non-consumers as well as those living in urban townships
DEPARTMENT OF TRADE AND INDUSTRY		
Consumer and Corporate Regulation Division (CCRD)	Creating a competitive, enabling economic environment that will inspire investors, consumer and business confidence in South African markets, products and services through fair, transparent, effective and predictable business regulation	Fruit and vegetable consumers
DEPARTMENT OF COMMUNICATIONS		
(public media entities e.g. South African Broadcasting Corporation (SABC))	Aiding in the dissemination of the healthy message of consuming fruit and vegetables	All persons who have access to any form of communication through media (e.g. radio, television)
DEPARTMENT OF CORRECTIONAL SERVICES		
	Provision of fruit and vegetables in daily menus	Prisoners; correctional officers
DEPARTMENT OF DEFENSE		
	Provision of fruit and vegetables in daily menus	Persons in the military
Note: the above refers to national, regional and local governments and municipalities.		

^a Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.1 Continued

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
PARASTATALS		
Land and Agricultural Development Bank of South Africa (Land Bank)	• Provides financial services for established and emerging farmers • Contributes to social upliftment and rural development	Established and emerging farmers; rural community
Agricultural Research Council (ARC)	To promote the agricultural and related sectors through research, technology development and transfer in order to: • Enhance the natural resource base and environment • Sustain a competitive agricultural economy • Provide new economic opportunities • Ensure high quality and safe food • Support and informed society	Farmers (both small and large-scale); fruit and vegetable consumers
National Agricultural Marketing Council (NAMC)	• Promotion of efficient marketing of agricultural products • Increasing of market access for all market participants • Enhancement of the viability of the agricultural sector	Farmers (small and large-scale); fruit and vegetable consumers and non-consumers
Perishable Products Export Control Board (PPECB)	• Controls all perishable exports from South Africa	Commercial farmers
Medical Research Council of South Africa (MRC)	• To improve the nation's health status and quality of life through relevant research in the area of fruit and vegetables that will eventually lead to increased consumption • To invest resources in high-quality and priority-driven research based on Burden of Disease priorities	Fruit and vegetable consumers and non-consumers
National Health Information Systems (NHIS)	• Monitoring the implementation and progress of fruit and vegetable programmes	Target groups of fruit and vegetable programmes
Council for Scientific and Industrial Research (CSIR)	• Performing research that is relevant to fruit and vegetable consumption • Plays a key role in ensuring the science and technology competence to address challenges of fruit and vegetable consumption at present and in the future	Fruit and vegetable consumers and non-consumers

^a Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.2 Possible stakeholders of fruit and vegetable promotion in the private sector in South Africa

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
Producer organisations:		
SA Litchi Growers' Association SA Mango Growers' Association SA Cactus Pear Growers' Association SA Avocado Growers' Association SA Tomato Producers' Organisation Banana Growers' Association of SA Potatoes SA Citrus Growers' Association of Southern Africa Organic Agricultural Association of SA	• To rationalise and promote the production and marketing of fruit and vegetables and fruit and vegetable products • Providing support and stimulus to assist producers to set sustainable production and marketing goals and maximise marketing potential and income	Farmers ^a (small and large-scale)
Deciduous Fruit Producers' Trust (DFPT): SA Apple and Pear Producers' Association (SAAPA) SA Stone Fruit Producers' Association (SASPA) SA Table Grapes (SAT)	• To protect and expand market share based on effective communication • The building of long term relationships • Lobbying with relevant authorities • Positioning deciduous fruit amongst relevant target audiences • The lowering of input costs and the enhancement of efficiencies in the export value chain • To enhance the long term economic viability and sustainability of the industry thereby increasing the bargaining position of the producers	

* SA: South African

^a Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.2 Continued

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
South African Vegetables (SA Veg)	• Mobilising funds and opportunities available within the national government and other sources to participate in national and international marketing and promotion actions to develop local markets • Coordination of industry matters and serving as a mouthpiece on a national level to review existing and introduce new regulations in cooperation with the National Department of Agriculture • Participate in negotiations with national and international authorities on industry matters such as import and export tariffs, the registration and use of chemicals and technical trade matters • Promote the consumption of vegetables locally and internationally by utilising existing promotional and marketing campaigns, and continuously educate consumers on health benefits of vegetables • Ensure growth of the industry by creating opportunities for existing and new participants, especially from previously disadvantaged communities. Involvement and endorsement of training initiatives to improve the technical knowledge of the industry	
Fresh produce markets:		
Johannesburg; Durban; Bloemfontein; Tshwane; East London; Epping; Kimberley; Klerksdorp; Nelspruit; Pietermaritzburg; Pietersburg; Port Elizabeth; Springs; Uitenhage; Vereeniging; Welkom; Witbank	• Provides fresh fruit and vegetables to individual consumers as well as wholesalers • Provides a safe market for growers to sell their produce • Maintaining a competitive marketing system and infrastructure • Provides opportunities for informal traders and entrepreneurs to generate income	Individual fruit and vegetable consumers (rural and urban); farmers (small and large-scale); entrepreneurs
Fresh Produce Market Authorities:		
Institute of Market Masters of SA (IMSA)	• Making sure the fresh produce market agents observe the rules of the market • Provide services that allow the fresh produce market agents to perform their role as well as possible	Fresh produce market agents

* SA: South African

^a Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.2 Continued

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
Agricultural Produce Agents Council (APAC)	Statutory responsibility to regulate the operation of the fresh produce market agents	Fresh produce market agents
Institute of Market Agents of South Africa (IMASA)		
	Represents the market agents operating the fresh produce markets	Fresh produce market agents
Fresh Produce Market agents		
(120 agents in SA)	- Marketing of fruit and vegetables at fresh produce markets on behalf of producers - Discovering the price of the produce and distributing it to the retailers	Farmers (small and large-scale)
Medical and insurance companies		
	- Reduction of medical costs - Efficiency of the health care system	Persons with medical aid and life insurance
Heads of companies and worksite management		
	- Creating an environment where fruit and vegetables are easily accessible and promoted - Ensuring an environment which is clean and has the proper facilities for preparation of fruit and vegetables	Persons employed by any company
Technological development:		
e.g. Technofresh; Freshmark systems	Provides the technical know-how and infrastructure to bridge the information gap between the producer, the markets and their market agents by means of information and computer technology	Farmers (small and large-scale)

* SA: South African

^a Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.2 Continued

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
Food service industry and associations:		
Restaurants Fast food outlets Catering companies Canteens Vending machines	Providing healthy food choices, low in fat and sodium, containing/including fruit and/or vegetables	Fruit and vegetable consumers (rural and urban)
Trade organisations: Federated Hospitality Association of South Africa (FEDHASA)	Influence quality and amount of fruit and vegetables offered by the hospitality industry	Persons making use of the hospitality industry
Fruit and vegetable industry and associations:		
Processing (canned, frozen, dried, fruit juices), packaging, transport, storage (all of the above has to do with the post-harvest handling of fruit and vegetables)	Ensuring high quality produce and/or products to the consumer by using the best post-harvest handling practices	Fruit and vegetable consumers (rural and urban)
Fruit and vegetable marketing associations:		
Wholesalers	- Controllers of supply and variety of fresh and processed fruit and vegetables - Involved in promotional campaigns	Persons who visit wholesalers, retailers or street vendors
Food retailers (small and large); chain groups		
Street vendors		
Importers	Controls the supply of seasonal variability of fruit and vegetables	Fruit and vegetable consumers and non-consumers

* SA: South African

^a Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.2 Continued

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
Fresh produce marketing association (FPMA)		
	• Representative body for the total fresh produce industry • Promote consumption of fresh fruit and vegetables • Provide a communication forum for all participants in production and marketing of fresh fruit and vegetables • Provide an information network on all aspects of fresh produce handling, training and nutrition • Provide forum for communication between marketers and allied associations, government and consumer groups	Government; farmers; fruit and vegetable consumers (rural and urban)
Agricultural input suppliers		
(Inputs are for example seed, pesticides, fertiliser, implements, machinery, etc.)	• Provision of inputs for fruit and vegetable production	Farmers (small and large-scale)
Media		
(Private media companies of example television, radio, journalists, newspapers, magazines, etc.)	• Aiding in the dissemination of the healthy message of consuming fruit and vegetables	All persons who have access to any form of communication through media (e.g. radio, television)
Financial institutions:		
Banks Micro-credit institutions Credit/loan officers	• Offering financial support to fruit and vegetable producers	Farmers (small and large-scale)

* SA: South African

^a Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.3 Possible non-governmental organisations/civil society which are stakeholders of fruit and vegetable promotion in South Africa

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
Consumers		
	They are the target groups where the increase of the consumption of fruit and vegetables needs to take place	All fruit and vegetable consumers
Community groups		
(e.g. garden, women's, cultural and religious groups)	To promote the intake of fruit and vegetables for overall health	Specific communities where these groups operate
Consumer groups:		
South African National Consumer Union (SANCU)	- To form a united consumer front that will coordinate all views on consumer-related matters of general and specific concern - To resolve the problems of consumers satisfactorily and to lobby continually for the establishment of effective complaint handling mechanisms - To liaise continually to bring about healthy relationships among consumers, producers, commerce, industry, financial institutions and the Government	All fruit and vegetable consumers
National Consumer Forum (NCF)	- Monitor and raise vital consumer issues - Focus on the consumption of goods and services, their motives and consequences, and the consumers' potential to positively influence them - Inform, generate opinion and coordinate campaigns - Work to increase consumers' influence on the market place	All fruit and vegetable consumers in South Africa
Women's organisations		
e.g. Federation of South African Women (FEDSAW)	Influences food choices of society	Fruit and vegetable consumers and non-consumers

NCDs: noncommunicable diseases

^a These stakeholders all need to have a consistent message regarding the health benefits and recommendations of fruit and vegetable intake

^b Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.3 Continued

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
Farmers' unions:		
Agri SA	• Mouthpiece for all South African farmers at national level • Ensuring the best possible financial and social position for the farmer within the national economy	Farmers ^b (small and large-scale)
National African Farmers Union (NAFU)	• To lobby for policy reforms aimed at leveling the field in all agricultural matters with particular reference to land acquisition, agricultural funding, market access and public policy • To lobby for the provision of appropriate services for example extension, marketing and credit to members • To identify, quantify and address the needs of members • To facilitate the provision of training • To empower women and young people so as to enable them to participate fully in farming activities	African small and large scale farmers, special emphasis on the inclusion of women and young people
Transvaal Agricultural Union (TAU SA)	Creating a platform for collective bargaining to ensure: • Economic sustainability • Recognition of private ownership rights • A safe and secure environment	Commercial farmers
Welfare organizations::		
(e.g. Valley Trust, Operation Hunger, Food Gardens Foundation)	• To include fruit and vegetables when providing food to the poor and less fortunate • To empower people to provide their own fruit and vegetables by educating, training and helping establish fruit and vegetable gardens	People aided by welfare organisations

NCDs: noncommunicable diseases

^a These stakeholders all need to have a consistent message regarding the health benefits and recommendations of fruit and vegetable intake^b Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.3 Continued

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
Traditional healers		
	To promote the intake of fruit and vegetables for overall health and for the prevention of specific NCDs for example diabetes	Community where the traditional healer is situated
Community/religious/traditional leaders		
	- To promote the intake of fruit and vegetables for overall health and for the prevention of specific NCDs for example diabetes - Provide leadership in establishing fruit and vegetable community gardens together with relevant stakeholders for example Department of Agriculture	Community where the specific leader is situated
5-A-Day for better health trust		
	Through promotion and education increase the consumption of fresh fruit and vegetables in South Africa resulting in a healthier nation	Fruit and vegetable industries; consumers; farmers; Government; health sector etc.
Health promotion organisations^a:		
Cancer Association of South Africa (CANSA) Heart Foundation of South Africa South African Heart Association South African Diabetes Association (SADA) Health System Trust South African Medical Association	- Promotion and education on the health benefits of consuming adequate fruit and vegetables - Education on the role of fruit and vegetables in the prevention of specific NCDs	Fruit and vegetable consumers and non-consumers; people suffering from specific NCDs

NCDs: noncommunicable diseases

^a These stakeholders all need to have a consistent message regarding the health benefits and recommendations of fruit and vegetable intake^b Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.3 Continued

STAKEHOLDER	REASON FOR INCLUSION	AREA OF GREATEST IMPACT
Health professional associations^a:		
Association for Dietetics in South Africa (ADSA) Nutrition Society of South Africa (NSSA) Health Professions Council of South Africa (HPCSA) Rural Doctors Association of Southern Africa (RuDasa) South African Nursing Council South African Medical Association	Promotion and education on the health benefits of consuming adequate fruit and vegetables	Fruit and vegetable consumers and non-consumers
Parent-teacher associations		
	Providing education and instruction of the health benefits of fruit and vegetables to parents and teachers	All children in schools in South Africa as well as their mothers and teachers

NCDs: noncommunicable diseases

^a These stakeholders all need to have a consistent message regarding the health benefits and recommendations of fruit and vegetable intake

^b Farmers: the word refers to fruit and vegetable farmers throughout the table.

Table 3.4 Possible international and regional stakeholders of fruit and vegetable promotion

STAKEHOLDER	REASON FOR INCLUSION
INTERNATIONAL	
International Fruit and Vegetable Alliance (IFAVA)	• To encourage and foster efforts to increase the consumption of fruit and vegetables globally for better health by supporting national initiatives, promoting efficiencies, facilitating collaboration on shared aims and providing global leadership. All of which is based on sound science
World Health Organization (WHO) and Food and Agricultural Organization of the United Nations (FAO) working jointly	• Sponsoring and brokering health-agriculture partnerships in member states to implement "Fruit and vegetables for health" initiatives. • Supporting countries in piloting and evaluating new projects to determine effective approaches for increasing intake, especially in developing countries • Taking the lead in the development of models of fruit and vegetable promotion interventions that are effective particularly in developing countries • Developing a simple evaluation tool that could be adapted in developing countries to facilitate measurement of the effectiveness of current and future interventions to promote fruit and vegetables • Helping to understand the effects of, and the potential and scope for incentives and subsidies to stimulate growth and efficiency in fruit and vegetable supply chains, by compiling lessons learned, positive and negative experiences and highlighting sensitive areas
International Union of Nutritional Sciences (IUNS)	• To promote advancement in nutrition science, research and development through international cooperation at the global level • To encourage collaboration and communication among nutrition scientists as well as to disseminate information in nutritional sciences through modern communication technology
International Fund for Agricultural Development (IFAD)	• International financial institution • Working with rural poor people, governments, donors, non-governmental organisations and any other partners, IFAD focuses on country-specific solutions, which can involve increasing rural poor peoples' access to financial services, markets, technology, land and other natural resources
United Nations Development Programme (UNDP)	• Advocating for change and connecting countries to knowledge, experience and resources • Helping countries build and share solutions to the challenges of poverty reduction • Encourage the protection of human rights and the empowerment of women

Table 3.4 Continued

United Nations World Food Programme (WFP)	• Works to put hunger at the centre of the international agenda, promoting policies, strategies and operations that directly benefit the poor and hungry
World Bank	• Provides loans, policy advice, technical assistance and knowledge sharing services to low and middle income countries to reduce poverty
World Trade Organization (WTO)	• Dealing with the rules of trade between nations
Consultative Group in International Agricultural Research (CGIAR)	• Mobilise agricultural science to reduce poverty, promote agricultural growth and protect the environment
International Food Policy Research Institute (IFPRI)	• Identifying and analysing alternative international, national, and local policies for improved food security and nutrition, with an emphasis on low-income countries and poor people and on the sound management of the natural resources base that supports agriculture • Contributing to capacity strengthening of people and institutions in developing countries conducting research on food policies • Actively engaging in policy communication, making research results available to all those in a position to apply or use them and carrying out dialogues with those users to link research and policy action
International Plant Genetic Resource Institute (IPGRI)	• The study and promotion of agricultural biodiversity
United Nations Children's Fund (UNICEF)	• Involving families and communities in UNICEF supported health and child development programmes • Improving the health of children • Health education • Plays a leading role in strengthening methodologies for the measurement and assessment of key indicators related to monitoring progress toward the Millennium Development Goals especially related to the situation of women and children • Innocenti Research Centre (main research arm of UNICEF) contributes to research, monitoring and policy analysis and in networking with others, including universities and research institutes

Table 3.4 Continued

STAKEHOLDER	REASON FOR INCLUSION
REGIONAL	
The New Partnership for Africa's Development (NEPAD)	• Increased investment in agriculture • Building and improving infrastructure • Promoting diversification of production of fruit and vegetables • Facilitating implementation of the food security and agricultural development programme in all sub-regions
Southern African Development Community (SADC)	• To promote sustainable and equitable economic growth and socio-economic development that will ensure poverty alleviation with the ultimate objective of its eradication • Enhance the standard and quality of life of the people of Southern Africa and support the socially disadvantaged through regional integration
Southern African New Crop Research Association (SANCRA)	• To examine current and developing issues in the production and marketability of new food and industrial crops • To provide a podium through which multi-disciplinary and multi-institutional scientific co-operation in new crop research in Southern African and Africa can be enhanced • To promote improved, sustainable, environmentally-friendly cultivation practices for new crops • To support and foster new crop development and utilisation through symposia, workshops, newsletters and publications • To present information to the general public on the place and value of new crops in agriculture and to encourage and contribute to education and training in this regard

Table 3.4 Continued

African Union (AU)	• To advance the development of the continent by promoting research in all fields, in particular in science and technology • To work with relevant international partners in the eradication of preventable diseases and the promotion of good health on the continent • To promote co-operation in all fields of human activity to raise the living standards of African peoples • To establish the necessary conditions which enable the continent to play its rightful role in the global economy and in international negotiations • To promote sustainable development at the economic, social and cultural levels as well as the integration of African economies
Southern African Regional Poverty Network (SARPNet)	• To contribute to the sustainable reduction of poverty through effective pro-poor policy, strategy and practice in the SADC region
<i>Note: the above includes the international bodies' national and/or regional representatives</i>	

The possible stakeholders from the four different sectors explicitly described above have an important role in achieving the national goal of increasing individual fruit and vegetable consumption. There is an opportunity to expand stakeholders' objectives with regard to fruit and vegetable production, communication, consumption, etc.

3.4 National coordinating team

3.4.1 Constitution of a national coordinating team

There is a need to ensure that a multisectoral coordinating mechanism, drawing upon existing structures, is present to promote fruit and vegetable production, supply and consumption. For South Africa, such a coordinating team should be selected. Members of this team should then draw upon other stakeholders (the most relevant stakeholders from the table of identified stakeholders presented earlier) and ensure visibility of the team. The coordinating team should provide leadership at national level and define mechanisms for its internal leadership.

The coordinating team should involve representatives from the following areas:

- Agriculture/horticulture sector
- Nutrition sector
- Public health sector (e.g. public health nurse)
- Education sector
- Financial sector
- Private sector
- Farmers unions, small-holders' associations (representing the producers)
- Consumers' associations
- Academic sector (especially for programme design and monitoring and evaluation)
- Local community leaders
- Women's groups.

3.4.2 Roles of the national coordinating team

The roles of the coordinating team include the following (FAO/WHO, 2005):

- To facilitate the development and implementation of national intervention programmes
- Create an environment for stakeholders to pursue these programmes with their respective departments and institutions
- Responsibility to guide and advocate for policies and actions (including research and extension) and strategies/action plans to be implemented by various stakeholders at various levels
- Coordinate the actions of the different stakeholders
- Monitor and evaluate different programmes aimed to increase consumption of fruit and/or vegetables and report on a regular basis

- National level coordinating team should be responsible for developing coordination of fruit and vegetable promotion at different administrative levels for example:
 - National
 - Regional
 - Municipal.

There are certain points that need to be taken into consideration with regard to the coordinating team and are the following:

- The coordinating team cannot develop policies, they can only guide
- They should promote the decentralisation process
- The team should have accountability and transparency.

Furthermore, leadership could be taken by the 5-A-Day for Better Health Trust and should ultimately be determined by the parties involved. The 5-A-Day campaign was introduced in South Africa in 1995 and is known as the 5-A-Day for Better Health Trust since 1999. The motivation for suggesting that the 5-A-Day for Better Health Trust take the leadership includes that the Trust is registered as a close corporation and has a proper structure with a Board of Trustees consisting of 10 members from different sectors involved in fruit and vegetable promotion and an existing method for the generation of funds is already in place. They are one of the founders of the International Fruit and Vegetable Alliance (IFAVA) and work together with the WHO in attempting to increase fruit and vegetable consumption in South Africa. Because this is an already running campaign, it would be of great value if this non-profitable organisation could obtain the endorsement of the national Department of Health who could support the already existing and future initiatives.

3.5 Identification of national goals and objectives

Goals differ according to the nutrition-related problems that fruit and vegetable promotion programmes are seeking to address. Goals for South Africa should ideally be identified by the suggested national coordinating team, relevant to the objectives set out by the fruit and vegetable promotion programmes. General goals as set out by the FAO/WHO (2005) are suggested below:

Overall goal

To contribute to the prevention and control of NCDs through increased production and consumption of a variety of fruit and vegetables

Health goal

- To improve the health status of all South Africans through the promotion of healthy lifestyles and the prevention of NCDs and the risk of overnutrition

Nutrition goals

- Increase fruit and vegetable intake:

Bring individual consumption of fruit and vegetables to at least 400 g/day in order to decrease prevalence and incidence of chronic diseases and reduce micronutrient deficiencies

Production goals

- Increase availability of fruit and vegetables:
Increase production, availability and/or variety of adequate amounts of fruit and vegetables to allow consumers to achieve the recommended consumption goal

Distribution goals

- Improve efficiency of distribution networks and marketing possibilities for small-scale producers of fruit and vegetables through availability of transparent price information and promotion of fair and sound practices by intermediaries.

3.5.1 Considerations regarding goal setting

National programmes should establish realistic and practical goals according to timeframes appropriate for the circumstances in South Africa.

Beneficiaries should be the national population, i.e. consumers, with positive side effects such as improving socio-economic status of producers.

Culturally relevant fruit and vegetable consumption targets should be set, but they should encourage people to increase the amount of fruit and vegetables they eat, preferably fresh or adequately processed.

The global long-term health target for the consumption of fruit and vegetables is a minimum of 400 g/day (WHO/FAO Expert Consultation, 2003).

Specific considerations according to circumstances in South Africa are:

- Most of the South African population does not come close to the recommended goal for fruit and vegetable consumption as clearly depicted in the literature review. In the report of the joint FAO/WHO Workshop on Fruit and vegetables for health (FAO/WHO, 2005), it is recommended that the short and/or medium-term goal for countries where consumption is low, should be lowered, because it may not be achievable or appropriate. One of the general barriers to fruit and vegetable consumption, however, is confusing recommendations regarding the intake thereof, hence different targets for different proportions of the population may lead to even more confusion. It is, therefore, recommended to keep the national goal for South Africa at 400 g/day, even if it may seem unreachable as a short-term goal. In interventions and strategies in different population groups with different consumption backgrounds, more prominence can thus be placed on the fruit and vegetable intake guideline of the South African Food-Based Dietary Guidelines, where definite figures are not the main emphasis
- Using the number of portions of fruit and vegetables required per day as introduced by the 5-A-Day for Better Health Trust may be very useful.

Objectives

Objectives need to be set at national level to reach these goals. The national coordinating team together with relevant stakeholders identified should discuss relevant short-term, medium-term and long-term objectives. Generic as well as specific objectives to be applied to reach the goals described above are also suggested. The following objectives are examples from the FAO/WHO (2005) and modified according to the current situation in South Africa:

Short-term

- To increase the number of people with home gardens by 15% within 3 years (Note that according to personal communication by Ms M. Mcata (2005) from the Directorate Food Security and Rural Development, Department of Agriculture, approximately 50% of the population have home gardens or access to at least a small piece of land, regardless of the availability of water and infrastructure to cultivate crops).

Medium-term

- To increase productivity within existing gardens by 20% within 5 years
- To increase diversity of crops grown to at least 3 per household within 5 years (Note that according to personal communication by Ms M. Mcata (2005) from the Directorate Food Security and Rural Development, Department of Agriculture, the majority of households, who grow vegetables, produce two different types of crops).

Long-term

- To increase the intake of fruit and vegetables to the recommended 400 g/day in the target group within 20 years.

Generic objectives

- Increase and diversify fruit and vegetable production, quality and safety
- Change knowledge, attitudes and behaviour of the population with regard to fruit and vegetable intake
- Improve infrastructure to enable consumers to produce fruit and vegetables for own consumption
- Create awareness within institutions (schools, workplaces, nursing homes, hospitals, prisons, military) of the need to increase fruit and vegetable consumption
- Increase availability and affordability of fruit and vegetables
- Promote community involvement in interventions and programmes so that transfer of ownership of projects can take place and communities can benefit economically as well
- Increase the amount and variety of fruit and vegetables consumed together with a reduction in fat intake for an improvement of general dietary pattern
- Sensitise civil society to the importance of fruit and vegetables through the media.

Specific objectives

- Assess current fruit and vegetable consumption to identify the most vulnerable groups with regard to fruit and vegetable intake by reviewing existing data (see consumption in South Africa as discussed in Chapter 2)
- Try to aim for the minimum recommendation of 400 g fruit and vegetables per day by implementing strategies, interventions and/or programmes developed to increase the fruit and vegetable intake of the different target groups
- Protect existing farm land and environmental resources
- Decrease post-harvest losses and educate target groups about appropriate conservation and preservation technologies (e.g. solar drying, pickling)
- Educate farmers on pesticide use and maximum pesticide residues permitted by Directorate Food Control
- Obtain introduction of policy to specify the amount of fruit and vegetables mandatory in the PSNP
- Promote micro-gardening technologies and rainwater harvesting.

In conclusion, it is seen that the national goal toward which South Africa should be striving is that of increasing individual fruit and vegetable consumption to 400 g/day. As a long-term objective it is suggested that it should be attempted to reach this goal in the target group within 20 years. It is useful to use the 5-A-Day concept as introduced by the 5-A-Day for Better Health Trust, referring to the number of fruit and vegetable portions which need to be consumed daily. Finally, the broad as well as specific objectives set out above will aid in reaching the national fruit and vegetable consumption goal.

3.6 Existing national policies and action plans

South Africa has subscribed to the universal declaration of human rights, which includes nutrition. The declaration was adopted for the first time in 1948 and states the following: *"Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food [...]"* (Universal Declaration of Human Rights, 1948).

South Africa also has food and nutrition as well as food security policies and/or action plans in which a fruit and vegetable promotion policy should ideally be embedded. The multisectoral coordinating team should identify relevant legislation, policies and programmes, including finance, agriculture, health promotion, environment and food policies.

There is an opportunity to up-date, integrate or revise national policies that do not consider fruit and vegetables. According to the FAO/WHO (2005), the coordinating team should also ensure relevant, practice-oriented research to inform policy development. The following policies and strategies need to be taken into account when planning fruit and vegetable promotion in South Africa:

Health promotion

Legislation

- Foodstuffs, Cosmetics and Disinfectants Act (1972)
- National Health Act (2003)
- Occupational Health and Safety Act (1993).

Policy documents and programmes

- Integrated Nutrition Programme (INP) (Department of Health, 2005)
- South African Food-Based Dietary Guidelines (Department of Health, 2004b)
- Strategic Priorities for the National Health System: 2004-2009 (Department of Health, 2004c)
- Health Research Policy in South Africa (Department of Health, 2001a)
- National Guideline on Primary Prevention of Chronic Diseases of Lifestyle (Department of Health, 2001b)
- National telemedicine programme and priorities in South Africa (Department of Health, 2001c)
- Policy Guidelines for Youth and Adolescent Health (Department of Health, 2001d)
- The District Health System in South Africa (Department of Health, 2001e)
- HIV/AIDS/STD Strategic Plan for South Africa: 2000-2005 (Department of Health, 2000)
- Health Sector Strategic Framework: 1999-2004 (Department of Health, 1999)
- Primary School Nutrition Programme (PSNP) (McCoy *et al.*, 1997).

Agriculture

Legislation

- Agricultural Debt Management Act (2001)
- Marketing of Agricultural Products Act (1996a)
- Agricultural Produce Agents Act (1992)
- Agricultural Product Standards Act (1990a)
- Agricultural Research Act (1990b)
- Agricultural Pests Act (1983a)
- Conservation of Agricultural Resources Act (1983b)
- Subdivision of Agricultural Land Act (1970)
- Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (1947).

Policy documents and programmes

- 2005 Strategic Plan for the Department of Agriculture (Department of Agriculture, 2005)
- Codex Alimentarius: pesticide residues in food (Codex Alimentarius, 2005)
- AgriBEE: Broad-Based Black Economic Empowerment Framework for Agriculture (Department of Agriculture, 2004)
- Agricultural marketing (Department of Agriculture, 2002a)
- Integrated Food Security Strategy for South Africa (Department of Agriculture, 2002b)
- Environmental Implementation Plan (Department of Agriculture, 2001a)

- Strategic Plan for South African Agriculture (Department of Agriculture, 2001b)
- Implementation Framework for the Landcare Programme (Department of Agriculture, 1999)
- Agricultural Policy in South Africa (Department of Agriculture, 1998)
- Food Security Policy for South Africa (Department of Agriculture, 1997)
- Growth, Employment and Redistribution Strategy (Department of Agriculture, 1996).

Environmental

Legislation

- National Environmental Management Act (1998a)
- National Water Act (1998b)
- Water Services Act (1997)
- Environment Conservation Act (1996).

Labour, land and water

Legislation

- Communal Land Rights Act (2004)
- Labour Relations Act (1995).

Policy documents and programmes

- Integrated Sustainable Rural Development Strategy (ISRDS) (Department of Land Affairs, 2001a)
- Land Redistribution for Agricultural Development (LRAD) (Department of Land Affairs, 2001b)
- Policy and strategy for groundwater quality management in South Africa (Department of Water Affairs and Forestry, 2000).

Education

Legislation

- National Education Policy Act (1996b).

Policy documents and programmes

- Teacher's Guide for Development of Learning Programmes: Life Orientation (Department of Education, 2003)
- Health promoting schools (Department of Health, 2004a)
- School health policy (Department of Health, 2003)
- Revised National Curriculum Statement Grades R-9 (Schools): Life Orientation (Department of Education, 2002).

Financial

Legislation

- Land and Agricultural Development Bank Act (2002)
- Value-added Tax Act (1991).

Public works

Policy documents and programmes

- Integrated poverty eradication strategy (Department of Social Development, 2000)
- Community Based Public Works Programme (Department of Public Works, 1994).

It is evident from the existing legislation and policies listed above, that South Africa has abundant acts, policies, programmes and strategies that need to be considered when planning fruit and vegetable interventions/programmes. The main areas of importance are health promotion, agriculture, environment, labour, land, water, education, finance and public works.

3.7 Possible interventions at national level

In the report of the FAO/WHO (2005), a number of possible interventions and/or areas of action to increase the consumption of fruit and vegetables are provided. It is, however, necessary to identify possible interventions to promote fruit and vegetable intake in South Africa.

What needs to be considered is whether the intervention programme is to be focused on vegetable or fruit intake, or both. Different issues need to be tackled to increase the consumption of each for example:

- Mostly, people enjoy eating fruit and it is easier to eat than vegetables. Barriers to their consumption may include seasonality, perishability and affordability
- Vegetables on the other hand, need to be prepared and it is necessary to educate people about preparing them.

It is important that every intervention or programme should be based on a thorough needs assessment and should incorporate a monitoring and evaluation plan.

The examples of areas for action and possible programmes provided in the report of the FAO/WHO (2005) for each consumer domain can be used as starting point and modified according to the situation experienced in South Africa.

Because of the complexity of interventions and/or programmes to promote the consumption of fruit and vegetables in South Africa and all the stakeholders involved from the planning to the implementation thereof, for the purpose of this dissertation, only a single example of a possible intervention to increase the consumption of fruit and vegetables for each consumer domain is provided in Table 3.5.

Table 3.5 Possible interventions to promote the consumption of fruit and vegetables

KEY AREAS OF ACTION	POSSIBLE INTERVENTIONS
<i>Rural small-holders</i>	
• Education	Pleading to strong commercial farmers to "adopt"/sponsor small-scale emerging farmers and implement education programmes on for example:

KEY AREAS OF ACTION	POSSIBLE INTERVENTIONS
	○ Staggered planting, cyclic production and crop rotation to ensure adequate supply of vegetables throughout the year ○ Pesticide and fertiliser use ○ Seasonality of different fruit and vegetables Education of especially women and children on home gardens
Market-dependent consumers	
• Media • Convenience	○ Increase advertising of fruit and vegetables through the media, for example free 20 spots on radio per month ○ Restrict advertising of high fat, high sodium foods at prime time for example between 6 pm and 7 pm for adults and during lunchtime for children ○ New innovation for convenience fruit and vegetables at affordable prices for example ready-to-eat, peeled fresh fruit and vegetables
Mixed consumers	
• Availability of land	○ Make land available in peri-urban and urban areas for gardening, for example community gardens in townships
Institutional consumers (children in schools)	
• Education • Provision	○ Revising the curricula for health education of benefits of fruit and vegetables and monitoring the implementation thereof ○ Specifying the amount of fruit and vegetables to be mandatory in the already existing PSNP

PSNP: Primary School Nutrition Programme

It would be the task of the suggested national coordinating team in South Africa to plan and implement both production and consumption interventions in rural, urban and peri-urban settings. The coordinating team should hence take into account what the context is where the selected interventions and/or programmes are to be introduced.

3.8 Monitoring and evaluation

Interventions and programmes are very expensive. It is, therefore, imperative that monitoring and evaluation needs to be undertaken to *inter alia* monitor and evaluate whether the target group is reached and whether the intervention is successful. The general principles and process of monitoring and evaluation are briefly discussed below.

The following general principles with regard to monitoring and evaluation should be stressed (FAO/WHO, 2005):

- Create a culture of evaluation with the national coordinating team and all persons involved in the planning and implementing of projects

- Incorporate monitoring and evaluation into the planning, design and implementation process and include a specific budget allocation for monitoring and evaluation
- Define the monitoring and evaluation strategy during programme design, ensuring the availability of baseline data and planning of initial surveys such that they can be used for monitoring in the future
- Use experts in the evaluation team (e.g. statistician, economist for cost-benefit analysis, programme manager to determine what should be evaluated)
- Do in-process monitoring frequently, but formal evaluations to change guidance less often
- Monitor all guiding principles mentioned earlier
- Ensure dissemination of evaluation results.

As shown in Table 3.6, Wentzel-Viljoen (2003) developed a framework for the evaluation of nutrition and nutrition-related programmes in South Africa. It is recommended that this framework also be used for the evaluation of fruit and vegetable promotion programmes in South Africa.

What type of evaluation should be conducted?

According to Wentzel-Viljoen (2003), a comprehensive evaluation of the nutrition or nutrition-related programme is the ideal. Babbie and Mouton (2001) define “comprehensive evaluation” as an evaluation that covers the objectives of all four types of evaluation, namely evaluation of need, the evaluation of programme (monitoring), the evaluation of outcome and impact and the evaluation of efficiency.

Need evaluation:

Evaluation of need is important to first of all identify the problem (e.g. low fruit and vegetable intake) and to determine the extent thereof. The target population also needs to be defined accurately as well as the nature of the services needed (Rossi *et al.*, 1999).

Implementation or process evaluation (monitoring):

Monitoring refers to the periodic and routine collection of information throughout the life of a programme to determine whether the programme delivery is proceeding as planned. It also provides essential information to understand and explain the outcomes of the programme evaluation (Wentzel-Viljoen, 2003). All programmes should include process evaluation for trouble-shooting and to achieve effective implementation.

The questions that should be answered with the monitoring include the following:

- Is the programme being implemented as planned?
- What are the constraints to implementation?
- Do the goods/services to be delivered meet the criteria as planned?
- Do the programme goods/services reach the defined target population?
- Are the programme goods/services delivered acceptable to the community?
- Is community participation proceeding on schedule?

Table 3.6 Framework for the evaluation of nutrition and nutrition-related programmes in South Africa (adapted from Wentzel-Viljoen, 2003)

Stage of the programme								
Description	I	II	III	IV	V	VI	VII	VIII
	Initiation of the programme	Planning of the programme	Programme inputs	Programme outputs	Primary programme outcomes	Secondary programme outcomes	Impact	Broader long-term benefits
						Programme impact		
What happens with the programme?	Identification of the programme: - Political decision - Evidence-based research decision	Development of the programme: - Conceptualisation - Logic model (cause-effect) including impact - Goals and objectives - Study design - Methodology - Target group - Coverage - Deliverables - Logistics - Resources - Pilot study, etc.	The delivery of goods and services to the target group as planned	Direct effect of delivery of goods and services	Direct effect of delivery of goods and services on the target group as planned	Secondary effect of goods and services delivered on the target group	Impacts of the goods and services delivered to the target group and generally reflect the primary objective of the programme	
Evaluation type	Need evaluation and programme theory evaluation #		Implementation or process evaluation (also named monitoring) #		Outcome/impact evaluation #	Impact evaluation Efficiency evaluation #		Long-term impact evaluation #
What happens with the evaluation?	A systematic approach of evaluation of the following: - Need for the programme - Basis for the problem identification - Conceptual framework - Goals and objectives - Target population identification - Intended/planned coverage - Deliverables - Logistics etc. - Feedback to the programme managers		A systematic approach to answer the following questions (only e.g.): - Is the programme implemented as planned? - Are the right goods and services delivered? - Are the goods and services delivered to the correct target group? - Coverage Should be part of the programme management: - Regular monitoring is essential - Feedback to the programme managers		Measures changes in behaviours and/or practices Links provision of goods and services to outcome	Impact evaluation: Measures whether interventions (goods and services delivered) actually produced the intended effects Efficiency evaluation (cost-benefit and cost-effectiveness): Provides a frame of reference for relating costs to programme results and is a means of judging the efficiency of the programme		Sustained effects resulting from the achievements of impacts, usually in combination with other factors. Might only be seen many years later

Steps (key elements) that should be included for the evaluation of each phase of the programme:

1. Identify and engage the stakeholders
2. Focus on the evaluation question
3. Develop the evaluation framework, indicators and measuring instruments
4. Gather high quality data and information
5. Justify the conclusion
6. Use and implement the evaluation

The information gathered through the monitoring process should be used to improve implementation. Corrective measures should then be identified, tested and implemented, as and where needed.

Outcome and impact evaluation:

This should be undertaken to assess whether intended outcomes have been achieved as a result of project implementation. The impact evaluation should focus on assessing whether the programme has reached its stated goals and assessing its success factors (FAO/WHO, 2005). Unintended impact should also be evaluated (Wentzel-Viljoen, 2003).

Efficiency evaluation:

Careful, rigorous evaluation needs to be conducted to test the cost-benefit and cost-effectiveness of the interventions/programmes in different contexts. This, however, does not have to be done for all programmes, because it tends to be cost and resource-intensive (FAO/WHO, 2005).

Important considerations when evaluating programmes (Strunge Meyer, 2004):

1. Pre versus post evaluation
2. Qualitative versus quantitative evaluation
3. Internal versus external evaluation (in some cases it might be beneficial to let an institution, not actively involved in the programme, do the evaluation, hence possibly minimising bias)
4. Intended versus observed behaviour (it is important to not only evaluate the behaviour which is parallel with the hypothesis, but to also evaluate any observed behaviour due to the intervention).

Selecting appropriate indicators (FAO/WHO, 2005)

Process evaluation

Indicators that mark whether the implementation of the programme/intervention has been successful include:

- Targeting (whether the intervention is reaching its targeted beneficiaries)
- Coverage (what percentage of the population is being reached?)
- Provision/delivery (whether the intervention is delivered as planned).

Outcome evaluation

Indicators that mark the outcome could be for example:

- Whether the fruit and vegetable intake has increased on household level and/or population level
- Whether the intake of fruit and vegetables has increased on individual level for different age groups
- Whether the availability of fruit and vegetable was increased.

Impact evaluation

Indicators that demonstrate whether the intervention is meeting its goals include:

- Whether nutritional status has changed (e.g. lower prevalence of micronutrient deficiencies)
- Whether risk factor profiles for NCDs have maintained or improved

- Whether overall health status has improved.

Some indicators from ongoing surveys could be used, for example:

- Dietary surveys for monitoring fruit and vegetable intakes
- Biochemical indicators for monitoring micronutrient deficiencies
- Anthropometric measures for monitoring obesity
- Illness and hospitalisation for monitoring chronic diseases.

It is recommended that the framework for the evaluation of nutrition and nutrition-related programmes in South Africa developed by Wentzel-Viljoen (2003) be used for the evaluation of national fruit and vegetable promotion programmes. Comprehensive evaluation should be undertaken which is evaluation that covers the objectives of all four types of evaluation, namely evaluation of need, the evaluation of the programme (monitoring), the evaluation of outcome and impact and the evaluation of efficiency.

3.9 Limitations of the strategy

Limited literature is available on the fruit and vegetable consumption behaviours of the different consumer domains in South Africa. The characteristics, entry points and barriers discussed, therefore, have in some instances been derived from personal experience and communication as well as extrapolated from those listed by the FAO/WHO (2005).

Due to the vastness of stakeholders involved in the fruit and vegetable consumption as well as production side, for the purpose of this dissertation only the most important stakeholders and in some cases, only examples of possible stakeholders of the different sectors are mentioned. It is recommended that an in-depth investigation into possible stakeholders involved should be undertaken.

As mentioned earlier, a national coordinating team needs to be appointed to plan and implement interventions and/or programmes to increase the consumption of fruit and vegetables in South Africa. The scope of this dissertation is, therefore, limited to examples of possible interventions, without in-depth analyses of *inter alia* the sustainability, possibility and affordability thereof.

3.10 Summary

To summarise the framework that has been presented above, it is necessary to obtain a clear over-all picture of the process followed. A national framework for South Africa has been developed by employing the global framework by the FAO/WHO (2005). The national coordinating team, suggested to be led by the 5-A-Day for Better Health Trust and selected out of the list of possible stakeholders, should be the driving force in implementing the framework in South Africa. Certain general principles, including availability and affordability, should be taken into consideration when planning national interventions/programmes promoting fruit and vegetable intake. The target group where fruit and vegetable consumption wishes to be augmented, needs to be accurately characterised using the relevant consumer domain identified earlier. The barriers to consumption of fruit and vegetables in the target

group need to be understood and novel ways to overcome them stipulated. During the process, existing national goals, objectives and legislation should provide guidance and opportunities to where fruit and vegetable promotion initiatives could be embedded. It is recommended that a culture of evaluation be created from the planning to implementing phase of interventions/programmes, hence supplying valuable feedback on the progress and success of the intervention.

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- Mr Thabo Ramashala – Directorate Plant Production Systems, Department of Agriculture
- Ms Mcumisa Mcata – Directorate Food Security and Rural Development, Department of Agriculture
- Mr Garfield Whiteboi – Directorate Business and Entrepreneurial Development, Department of Agriculture
- Ms Prudence Monyelo – Directorate Health Promotion, Department of Health
- Mr Mike Louffie – Chairman – 5-A-Day for Better Health Trust
- Ms Hester Du Toit – 5-A-Day programme manager South Africa
- Ms Mary Romarola - Operations manager, Klerksdorp fresh produce market
- Ms Elbie Rheeder – Regional Department of health, Potchefstroom
- Ms Karin Schingerling - student who coordinated vegetable gardens at farm schools
- Teachers at farm schools listed below.

Places visited in the North West Province:

City/Nearest city	Specific place/area	Classification
Klerksdorp	Klerksdorp Fresh Produce Market	Private sector
Potchefstroom/Ventersdorp/ Carletonville	Vyfhoek, Padi, De Beers Kraal, Sizamele	Farm schools
<i>Selected households in the following areas:</i>		
Potchefstroom:	Potchefstroom	Urban formal
Carletonville:	Khutsong	Urban township

City/Nearest city	Specific place/area	Classification
Brits:	Oos-Driefontein	Urban formal (mine village)
	Surrounding farms	Rural (Farmers and farm workers)
	Lethlabile	Urban township
	Tladistad	Rural
Lichtenburg:	Surrounding farms	Rural (Farmers and farm workers)
	Itsoseng (Zone 1 and 3)	Urban township
	Mmabatho	Rural (tribal village)
Rustenburg:	Bojating	Rural (tribal village)
	Bafokeng	Rural (tribal village)
	Phatsima and Ledig	Urban township in rural area

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DEPARTMENT of Public Works *see* SOUTH AFRICA. Department of Public Works.

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CHAPTER 4

4 CONCLUSIONS AND RECOMMENDATIONS

The theory is that increased intakes of fruit and vegetables will address both undernutrition and overnutrition, which are both apparent in South Africa. Overnutrition, suggesting diets where more energy is taken in than is needed to cover the body's needs, can contribute to the development of NCDs. The focus in this dissertation was on fruit and vegetables contributing to the prevention of NCDs.

Noncommunicable diseases were the number one cause of death in South Africa in the year 2000 and accounted for 37% of the deaths. More specifically, CVD as a whole was the second leading cause of death in South Africa and accounted for 17% of total deaths (Bradshaw *et al.*, 2003). With regard to cancer and diabetes, South African males and females have an approximate lifetime risk of developing cancer of 1 in 5 and 1 in 6 respectively (Sitas *et al.*, 1996) and self-reported diabetes rates were 2% for men and 4% for women (Department of Health, 1998).

Although the estimation of the number of portions of fruit and vegetables consumed by South Africans per day cannot be estimated from the published data available in South Africa, it is evident that overall intakes of fruit and vegetables do not meet the global recommendation of 400 g daily. It is recommended that a re-analyses of the raw data compiled by Nel and Steyn (2002) should be done in order to calculate the average portions of fruit and vegetables consumed per day and to identify the most vulnerable groups with regard to fruit and vegetable consumption.

Fruit and vegetable consumption has consistently shown a significant inverse association with the development of diabetes, CVDs and certain cancers. The study populations included in the review of the prospective evidence regarding fruit and vegetable intake and CVDs and diabetes mellitus were in Europe (Denmark, Finland, Netherlands, United Kingdom), Japan and the USA (Bazzano, 2005). The literature searches used did not identify any prospective studies from developing countries. Limited evidence from developing nations regarding fruit and vegetable intake and incidence of cancer were also evident in the reviews evaluated (WHO/FAO Expert Consultation, 2003; WCRF/AICR, 1997).

The limited amount of literature from developing countries is distressing, not only because there may be a genetic diversity in the metabolic response to dietary risk factors, but also because a different environmental exposure might limit or confound the health impact of fruit and vegetables. Another concern is that the fruit and vegetables consumed, for instance in South Africa, may be largely different from those habitually consumed in the Western world. The way fruit and vegetables are stored, processed, cooked and consumed are also very different not only across, but even among different populations within countries.

The question therefore remains whether the same effects can be expected in the South African population. The need for well-designed trials in developing nations are clearly visible and may also help to

evaluate the importance of specific indigenous fruit and vegetables which are not yet widely consumed in other parts of the world.

The importance of a strategy to promote fruit and vegetable consumption, however, has been clearly demonstrated. In South Africa, as in other developing countries, an increase in the consumption of fruit and vegetables could contribute in the prevention of both undernutrition and diseases caused by overnutrition. A strategic framework for the increase in fruit and vegetable consumption in South Africa was developed using the report of the FAO/WHO (2005) as guiding document. Consumers in South Africa are characterised into the following consumer domains, rural small-holders producing fruit and vegetables for their own consumption, market-dependent consumers who are totally dependent on markets to procure fruit and vegetables, mixed consumers who produce some fruit and vegetables for own consumption, but who are also dependent on market supply and institutional consumers for whom fruit and vegetables are supplied by the specific institution. The most commonly perceived barriers to eating fruit and vegetables are affordability, availability and household taste preference.

The recommended national goal for fruit and vegetable consumption is 400 g/day. Possible stakeholders involved in reaching this goal fall primarily under the public sector, private sector, non-governmental organisations and international stakeholders. There is an opportunity to revise existing national policies and programmes that do not consider fruit and vegetables for example specifying the amount of fruit and vegetables to be mandatory in the PSNP.

The way forward would be to create a national coordinating team and at the same time involve broader stakeholder participation. This team would provide leadership at national level by *inter alia* developing sustainable and cost-effective interventions through applying the proposed framework, whilst focusing on the most vulnerable target groups.

It is recommended that the driving force of the above mentioned process should be South Africa's 5-A-Day for Better Health Trust. The Trust has the capacity to provide the leadership in implementing the suggested framework in South Africa. Practical steps that need to be taken are schematically illustrated in Figure 4.1. First of all the 5-A-Day for Better Health Trust needs to commit itself to taking the leadership and carrying the responsibility of implementing the suggested framework. It, however, needs to be capacitated further with regard to the generation of funds and the increase in human resources, seeing that the trust has a lack of permanent staff (only one permanent employee). The Trust's existing mission statement is the following: "Through promotion and education, increase the consumption of fresh fruit and vegetables in the Republic of South Africa, resulting in a healthier nation". The expansion of the objectives of the Trust, therefore, needs attention. The extension of the existing Board of Trustees could be of great value for the trust to fulfil its potential.

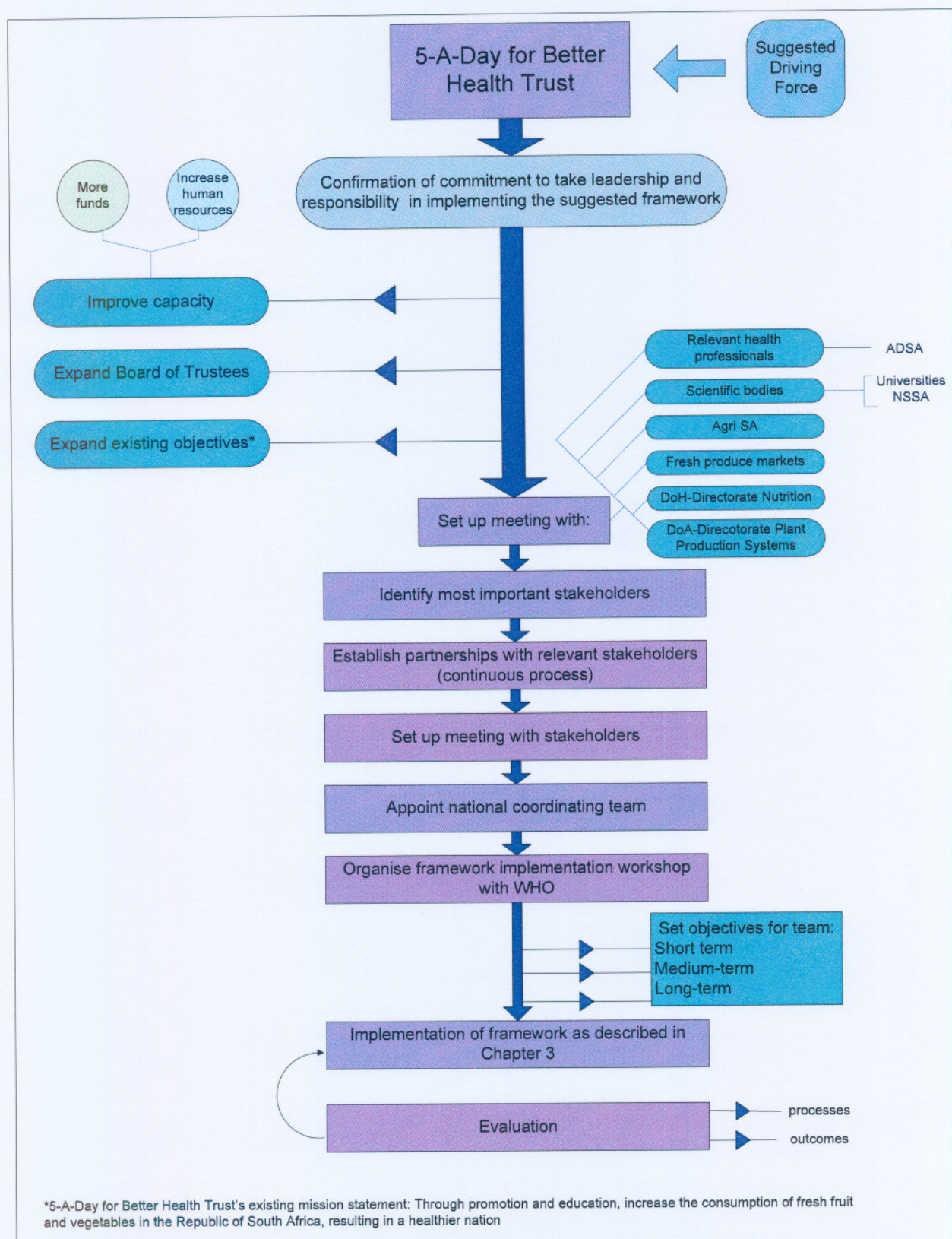


Figure 4.1 Practical steps to the implementation of a national framework to promote fruit and vegetables in South Africa

ADSA: Association for Dietetics in South Africa; DoA: Department of Agriculture; DoH: Department of Health; NSSA: Nutrition Society of South Africa

The following step would be to set up a meeting with the following entities:

- Directorate Nutrition (Department of Health)
- Agri SA
- Fresh produce markets
- Scientific bodies inter alia NSSA and universities
- Directorate Plant Production Systems (Department of Agriculture)
- Relevant health professionals including ADSA.

The goal of the meeting would be to identify the most important stakeholders involved in the promotion of fruit and vegetables in South Africa. The establishment of partnerships with the relevant identified stakeholders is crucial and should be an ongoing process. A meeting should be set up where all the identified most important stakeholders are present to appoint a national coordinating team.

The plans of the WHO for 2006 are to hold framework implementation workshops in Argentina and the Pacific Islands and possible country workshops in Mozambique and other lusophone countries. Discussions could be held with the WHO to hold an implementation workshop in South Africa, preferably with the national coordinating team and most important stakeholders.

Short-term, medium-term and long-term objectives need to be set for the national coordinating team, whereafter the implementation of the framework, as described in Chapter 3, should take place.

From the planning to the implementation of projects, interventions or programmes, the evaluation of processes and outcomes should be on the forefront. The evaluation and monitoring of interventions are a continuous process.

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