The validation of a suitable Nutrient Profiling model for South Africa

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ABSTRACT

AIM

Nutrient profiling is defined as 'the science of classifying or ranking food items according to their nutritional composition for reasons related to preventing disease and promoting health, and can be used to govern the criteria under which nutrient and/or health claims may be made'. The validation of a nutrient profiling model (NPM) is an essential part of the model development process, and is extremely important for the model to meet basic scientific criteria. This mini-dissertation investigated the content and convergent validity of a suitable NPM for South Africa.

METHOD

Content validity was tested for by comparing the NPM classification of 131 'indicator' foods with the classification of the 'indicator' foods by the Food Based Dietary Guidelines (FBDGs). Convergent validity was tested for by comparing the standard ranking of a representative data set of food items (n = 128) by nutrition experts with the classification of the food items by the NPM. The questionnaire asked respondents to rank 40 foods (electronically generated from a master list of 128 foods) according to the nutritional information provided from *'more healthy'* to *'less healthy'* using a six point Likert scale. The 128 foods were selected to be representative of the South African diet. These questionnaires were sent via e-mail to all full members (n = 1105) of the Association of Dietetics in South Africa. The draft 'Guiding principles and framework manual for the development or adaptation of nutrient profile models' dated 22 February 2011 (WHO, 2011), was used as a guide in the validation process of the NPM.

RESULTS

The NPM showed good content validity: the way that the NPM categorises foods correspond well with that of the FBDGs (kappa statistic = 0.73). Two hundred and ninety two responses were received (26.4%) from the nutrition experts, these responses were used to rank the 128 foods by the average score which they received from the nutrition experts. The NPM also showed good convergent validity: the NPM classification of foods had a good correlation with the standard ranking of foods by dietitians (r = 0.853; p = 0.0001).

CONCLUSION

The NPM demonstrated good content validity by classifying food items in way that supports the FBDGs with the exception of a few processed food items and combined food items. The NPM also demonstrated good convergent validity by classifying food items in accordance with the views of nutrition experts in South Africa.

Key words: nutrient profile, healthiness of food, validity, food perceptions

OPSOMMING

DOEL

Die samestelling van ‘n voedingstof profiel model (VSP) kan gedefinieer word as ‘die wetenskap van die klassifisering en gradering van ‘n voedsel item volgens die voedingstof-samestelling van daardie item’. Die VSP-model kan ook gebruik word om voedingstof- en/of ‘n gesondheidsaansprake van voedsel-items te bestuur. Die validering van ‘n VSP-model is ‘n noodsaaklike element in die ontwikkeling en toetsing van die model, en is essensieel vir die klassifisering van die model as ‘n wetenskaplike benadering.

METODE

Die inhoud geldigheid van die VSP-model was getoets deur die klassifisering van 131 ‘aanwyser’ voedels deur die VSP-model te vergelyk met die Suid-Afrikaanse Voedsel Gebaseerde Dieet Riglyne (VGDR). Die konvergerende gegrondheid van die SVP-model was getoets deur die standaard rangorde waarin voedingdeskundiges ‘n verteenwoordigende datastel van voedsels (n = 128) geplaas het te vergelyk met die SVP-model klassifikasie van die voedsel items. Die vraelys is aan 1105 lede van die Vereniging van Dieetkundiges in Suid Afrika (ADSA).

RESULTATE

Die SVP-model het goeie inhoud geldiheid getoon, die mate waarin die SVP-model geklassifikasie van ‘aanwyser’ voedsel het ‘n goeie ooreenkoms gehad met die FBDGs (kappa statistiek = 0.73). Twee-honderd-twee en-negentig vraelyste was terug ontvang vanaf die voedingdeskundiges (26.4%). Die VSP-model het ook goeie konvergerende geldigheid getoon: die SVP-model klassifikasie van voedsels het ‘n goeie korrelasie getoon met die gradering van voedsels deur dieetkundiges.

GEVOLGTREKKING

Die VSP-model het goeie inhoud geldigheid getoon deur voedsels te klassifiseer op ‘n manier wat die VGDR ondersteun. Die VSP-model het ook goeie konvergerende geldigheid getoon deur voedsel te klassifiseer in ooreenstemming met die voedingdeskundiges se persepsie van voedsels.

Sleutelwoorde: Voedingstof profiele, gesonheid van voedsels, geldigheid, gegrondheid, persepsies van voedsels.

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I thank you all for your constant friendship and support in tough times.

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LIST OF ABBREVIATIONS

ADSA	Association of Dietetics South Africa
AIDS	Acquired Immunodeficiency Syndrome
BGH	Balance of Good Health
DOH	Department of Health
FAO	Food and Agriculture Organisation
FVLN	Fruits, Vegetables, Legumes and Nuts
FBDGs	Food Based Dietary Guidelines of South Africa
FCTSA	Condensed Food Composition Tables of South Africa
FSANZ	Food Standards Australia New Zeeland
HIV	Human Immunodeficiency Virus
MRC	Medical Research Council
NCDs	Non Communicable Diseases
No	Number
NPM	Nutrient Profiling Model
NSSA	Nutrition Society of South Africa
NWU	North West University
UK	United Kingdom
WHO	World Health Organization

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CHAPTER 1

1. INTRODUCTION

1.1 Background and problem statement

The global burden of non-communicable diseases (NCDs) continues to grow and attempting to combat this global burden is one of the major challenges of the twenty-first century (WHO, 2008). The global estimates indicate that thirty five million (35 million) deaths in 2005 was caused by NCDs, primarily cardiovascular disease, diabetes, cancers, and chronic respiratory diseases (WHO, 2008). Bradshaw and researches (2003) reported that an estimated 21% of mortalities in South Africa in the year 2000 were caused by NCDs. The WHO estimates that the total deaths from NCDs will increase by a further 17% within the next 10 years.

In 2003, a report of a joint WHO/FAO (World Health Organization/ Food and Agriculture Organization) expert consultation pointed out the potential role of a diet high in nutrients such as fat, saturated fatty acids, trans fatty acids, sugars and salt/sodium, when excessively consumed, in the development of these chronic NCDs (Garsetti *et al.,* 2007). Recognising the opportunity for reducing deaths by improving diets and increasing physical activity the World Health Assembly (WHA) adopted the WHO Global Strategy on Diet, Physical Activity and Health in May 2004 (WHO, 2004).

South Africa has a lively and growing food industry that wants to provide for both the health needs and wants of the South African consumers, whilst still remaining profitable (Wentzel-Viljoen *et al.,* 2010). In the last decade, health has become an important issue within the food industry and as a result numerous food items making nutrient and/or health claims have been launched on the market. The mandate of the Department of Health (DOH), Directorate: Food Control *in terms of labelling of foodstuffs* (Foodstuffs, Cosmetics and Disinfectants Act, no 54/1972) is:

- To inform and educate the consumer in order to make an informed decision when purchasing a foodstuff
- To protect the consumer from any misleading or deceptive practices which may affect the consumer in terms of his health
- To inform, educate and protect the food manufacturer.

The DOH, Directorate: Food Control published draft Regulations Governing the Advertising and Labelling of Foodstuffs, No R. 642 for comments in the Government Gazette on 20 July 2007. One of the key objectives and fundamental principles behind the Regulations are to promote healthier eating habits through improved labelling and advertising, thereby encouraging better food choices in order to improve public health by reducing the incidences of chronic diseases of lifestyle in the long term. These fundamental principles are in line with the FAO/WHO Global Strategy for Diet, Physical Activity and Health (WHO, 2004).

One hundred and three (103) sets of comments were received on the draft Regulations (No R. 642 of 2007) from local and international stakeholders. There was general appreciation and support from most role players but it was also highlighted that several issues require further attention based on sound and scientific evidence to enable the Directorate: Food Control to finalise the draft Regulations (No R. 642 of 2007).

The section of the draft Regulations (No R. 642 of 2007) widely commented on by the scientific community as well as the food industry, was *Annexure 6 "Foodstuffs not considered essential for a healthy diet and for which NO nutrient content, GI, certain comparative, health, slimming or any other claim with a health or nutritional message will be permitted".* The implementation of Annexure 6 would prohibit numerous foodstuffs from making any nutrient and/or health claim. From the comments received it was clear to the Directorate: Food Control that there was general appreciation and support from most role players for one of the key objectives and fundamental principles behind the Regulations, namely to promote healthier eating through improved labelling, but that Annexure 6 would have to be dealt with in a more scientific manner. It was reasoned that in order to deal with Annexure 6 of the draft Regulation (No R. 642 of 2007) in an objective, rather than subjective manner, a nutrient profiling model applicable to all food categories would have to be developed in order to satisfy stakeholders demands for a scientific and evidence based approach to regulation food labels.

A report "Evaluation of existing nutrient profiling models" (Wentzel-Viljoen *et al.,* 2010) was completed as the first step towards the development, testing and evaluation of a suitable nutrient profiling model for South Africa. A suitable nutrient profiling model would provide the DOH: Directorate Food Control with a scientific evidence-based approach to determine the eligibility of a food item to carry a nutrient and/or health claim and would address the most debatable issue covered by the draft Regulation (No R. 642 of 2007).

1.2 Purpose and importance of the study

Nutrient profiling is defined as 'the science of categorising foods according to their nutritional composition' (Rayner *et al.,* 2005; Scarborough *et al.,* 2007a) and can be used to score the 'healthiness' of individual foods whilst governing the criteria under which nutrient and/or health claims may or may not be made.

Validation is a vital step in the development of a nutrient profiling model, as it ensures that the final model is based on sound scientific principles and therefore that the use of the nutrient profiling model to determine the eligibility of a food item to carry a nutrient and/or health claim can be said to be evidence-based (WHO, 2011). Without proper validation, any model would be questioned by nutrition scientists and the food industry.

1.3 Aim and objectives

1.3.1 Overall aim

The aim of this study is to validate a suitable nutrient profiling model for South Africa, according to the first two validation approaches as recommended in the "Guiding principles and framework manual for the development or adaptation of nutrient profiling models' (WHO, 2011), with the aim of assessing the eligibility of a food item to carry a nutrient and/or health claim.

1.3.2 Specific objectives

In order to address the given aim the following specific objectives were set:

i. To conduct content validity testing by comparing the classification of a number of 'indicator' food items as determined by the nutrient profiling model with the Food Based Dietary Guidelines (FBDGs).
ii. To conduct convergent validity testing by comparing the standard ranking of food items as determined by nutrition experts to the classification of the same food items by the nutrient profiling model.

1.4 Noteworthy information

This mini-dissertation forms part of larger study conducted by Wentzel–Viljoen and researchers (2012). The selected nutrient profiling model was tested and a software programme based on the nutrient profiling model was developed. All the validation approaches as described in the 'Guiding principles and framework manual for the

development or adaptation of nutrient profiling models' (WHO, 2011), was used. This mini-dissertation will however only report on the first two approaches to the validation of a nutrient profiling model as described in the guidelines namely, the content and convergent validity assessment of the nutrient profiling model.

1.5 Definitions

1.5.1 Nutrient profiling

The science of categorising or ranking foods according to their nutritional composition for reasons related to preventing disease and promoting health (WHO, 2011).

1.5.2 Food Based Dietary Guidelines (FBDGs)

FBDGS are a series of guidelines that have been constructed by sub-national, national or international organisations which are designed to help individuals achieve a healthy diet. The distinction between FBDGs and nutrient recommendations is that FBDGs consist of statements relating to specific foods or food categories rather than to specific nutrients (WHO, 2011).

1.5.3 Claim

A claim in relation to a food stuff, means any written, pictorial, visual, descriptive or verbal statement, communication, representation or reference brought to the attention of the public in any manner including a trade name or brand name and referring to the characteristics of a product in particular to its nature, identity, nutritional properties, composition, quality, durability, origin or method of manufacture of the product (as per Regulation 146 of 2010, DOH: Directorate food control).

1.5.4 Health claims

A health claim is a claim that a food item (or its components) is related to the health of the consumers such as 'good for your heart', and 'healthier option' (WHO, 2011).

1.5.5 Nutrient claim

A nutrient claim is a claim that is made about the levels of a nutrient in a food item such as 'low fat' or 'source of fibre' (WHO, 2011).

1.5.6 Total sugar

The total sugar content of a food item refers to the sum of all intrinsic and added sugars (as per Regulation 146 of 2010, DOH: Directorate food control).

1.5.7 Added sugar

The added sugar content of a food item refers to any sugar added to food stuffs during processing and includes but is not limited to sugar as defined by Regulations Relating to the Use of Sweeteners in Foodstuffs under the Act, honey, molasses, sucrose with added molasses, coloured sugar, fruit juice concentrate, deflavoured and/or deionised fruit juice and concentrates thereof, high fructose corn syrup and malt or any other syrup of various origins (as per Regulation 146 of 2010, DOH: Directorate food control).

1.6 Structure of this dissertation

This mini-dissertation is presented in the chapter format but in a manner similar to that of an article format, as it is the intention to submit this research for publication in a peer-reviewed journal. The format used also facilitates the reading and understanding of this research.

Following the introductory chapter (Chapter 1) is the literature review (Chapter 2). In Chapter 2, available published literature has been reviewed with regards to nutrient profiling, nutrient and/or health claims, regulations governing food labelling and the validation of nutrient profiling models. Published literature with regards to the validation of nutrient profiling models are extremely limited, the research reported in this mini-dissertation is cutting edge information as it is only the second time that validity testing of a nutrient profiling model have been completed. Chapter 2 concludes with the discussion on the different methods of validating a nutrient profiling model as described in the 'Guiding principles and framework manual for the development or adaptation of nutrient profile models' (WHO, 2011).

Chapter 3 (Content validity) contains the method, results, discussion and conclusion for testing for content validity in a suitable nutrient profiling model.

Chapter 4 (Convergent validity) contains the method, results, discussion and conclusion for testing for convergent validity in a suitable nutrient profiling model.

The last chapter (Chapter 5) summarises the main findings of the research study to form a collective conclusion chapter of the two methods of validation used in this mini-dissertation.

Some recommendations for future studies with regards to the validation of nutrient profiling models are also included.

A combined reference list for chapters 1 to 4 has been compiled, followed by the addenda.

CHAPTER 2

2. LITERATURE REVIEW

Nutrient profiling is defined as 'the science of categorising foods according to their nutritional composition' (Rayner *et al.,* 2005; Scarborough *et al.,* 2007a). Nutrient profiling is primarily concerned with the nutrient and the energy content of food items. Nutrient profiling assigns foods into categories based on their nutrient content and has many potential uses, ranging from consumer education and dietary guidance to food labelling and the regulation of nutrient and/or health claims (Zelman & Kennedy, 2005). Literature with regards to the validation of nutrient profiling models is extremely limited; the only validity testing of a nutrient profiling model to date was completed by Scarborough and co-workers (2007a; 2007b) and Arambepola and co-workers (2008).

2.1 The burden of non-communicable diseases

The burden of disease information is an important component of health information required for health planning, as it can be used to identify the health gaps in the population that needs to be addressed in order to improve the health of that population (Bradshaw *et al.,* 2003). The prevalence of chronic non-communicable diseases (NCDs) including type 2 diabetes mellitus, cardiovascular disease and obesity has increased in the majority of countries in recent years (Garsetti*, et al*., 2007). Bradshaw and colleagues (2003) reported that an estimated 21% of mortalities in South Africa in the year 2000 were caused by NCDs. Among these NCDs, a stroke was the most significant cause for death in females and ischemic heart diseases the most significant cause in men. The WHO estimates of the burden of disease in South Africa in 2004 suggested that NCDs caused 28% of the total burden of disease measured by disability-adjusted life years (WHO, 2008). Evidence has shown that 90% of coronary heart disease, 90% of type 2 diabetes and 30% of cancers could be avoided by an adequate lifestyle, and nutrition is recognised as a critically important lifestyle factor (WHO, 2003).

South Africa is in the midst of a nutrition transition motivated by the rapid urbanisation of Africans (Vorster *et al*., 2005). Urbanisation is accompanied by acculturation and modernisation, which has shown a rise in NCDs, driven by an increase in relevant risk factors in urban and rural areas (Alberts *et al.,* 2005). Many NCDs share common risk factors such as tobacco use, physical inactivity and an unhealthy diet which translates into cardiovascular disease, diabetes, and cancer (Mayosi *et al.,* 2009). Bourne and co-workers (2002) reported that; the national prevalence data from South Africa indicate that the shifts in

dietary intake are occurring with increasing momentum, particularly in black people who constitute more than three-quarters of the population.

South Africa is faced with a unique quadruple burden of disease – a combination of pre-transitional diseases and conditions related to poverty, the emerging chronic diseases, injuries and the human immunodeficiency virus (HIV) or acquired immunodeficiency syndrome (AIDS) (Bradshaw *et al.,* 2003). The age-adjusted prevalence of hypertension in the South African adult population is 25.2% which amounts to 6 million South Africans (Steyn *et al.,* 1998a; Charlton *et al.,* 2005). The diagnosis, management, and control of hypertension and other NCDs are poor, particularly in the black population (Carlton *et al.,* 2005; Steyn *et al.,* 2001; Steyn 1998; Moodley *et al.,* 1997; Mollentze *et al.,* 1995). The situation is unlikely to improve because the public health sector, where the majority of the patients with hypertension and other NCDs receive medical care, is already overburdened with budgetary constraints, particularly in light of the epidemic of HIV and AIDS. It is thus evident that non-pharmacologic approaches to decrease blood pressure and manage NCDs at a population level are required to curb the predicted escalating increase in the rate of hypertension and other NCDs (Charlton *et al.,* 2005; Steyn *et al.,* 1998a).

2.2 Dietary intake and health

During the past 30 years, epidemiological and experimental research has produced a consistent and convincing body of scientific evidence linking nutrition and food behaviour or food choices to health (Azaïs-Braesco *et al.,* 2006). According to Azaïs-Braesco *et al.* (2006) numerous studies have associated for example, a high consumption of fruits and vegetables to a weaker occurrence of cardiovascular diseases and cancer, or the intake of high amounts saturated fats to a greater risk of vascular pathologies. In 2003, a report of a joint WHO/FAO (World Health Organization/ Food and Agriculture Organization) expert consultation pointed out the potential role of a diet high in nutrients such as fat, saturated fatty acids, trans fatty acids, sugars and salt/sodium, when excessively consumed, in the development of these chronic NCDs (WHO, 2003). Therefore, a diet high in fat, saturated fatty acids, trans fatty acids, sugars and salt/sodium can be classified as an unhealthy diet which is a major cause in many NCDs.

The current focus regarding nutrition intervention is to improve the quality of the general populations' diet in order to prevent diseases of lifestyle. The main objective is of course to modify food behaviour towards a more balanced diet; however the improvement of the nutritional quality of individual foodstuffs should not be neglected. Public health authorities

have initiated a number of educational and communication campaigns in order to promote a healthy and balanced diet, for example the Food Based Dietary Guidelines (FBDGs).

2.3 The South African Food Based Dietary Guidelines

One of the goals of the World Declaration and Plan of Action for Nutrition adopted at the 1992 FAO/WHO International Conference on Nutrition in Rome is the global elimination or substantial reduction of malnutrition, micronutrient malnutrition and diet-related communicable and non-communicable disease (FAO/WHO, 1992; Vorster *et al.,* 1998b). The promotion of appropriate nutritional intake and healthy lifestyles has been identified by the FAO & WHO as a strategy to accomplish the above mentioned goal. The failure of nutrient-based guidelines to substantially influence dietary patterns of different populations stimulated another FAO/WHO initiative, to establish the scientific basis for developing and using food-based dietary guidelines (FBDGs) relating to practices and prevailing nutrition-related public health problems (FAO/WHO, 1996; Vorster *et al.,* 2001).

South Africa is faced with a quadruple burden of disease namely infectious diseases such as TB and HIV, the increasing prevalence of chronic NCDs, malnutrition and injuries. Many of these chronic diseases are caused by factors such as overweight, lack of physical activity and a poor diet (high fat and sugar intake and low fruit and vegetables consumption). The Nutrition Society of South Africa (NSSA), motivated by the FAO/WHO initiatives, formed a representative working group consisting of delegates from academia, NSSA, Association of Dietetics South Africa (ADSA), the Medical Research Council (MRC), DOH, The United Nations Children's Fund (UNICEF), the agricultural sector, food industry and an observer from the FAO, that assisted in the development of FBDGs that would be appropriate for the whole South African population. The working group considered each word carefully, and formulated each guideline based on available scientific evidence (or the lack thereof) according to the accepted characteristics of ideal FBDGs (Vorster *et al.,* 2001).

The FBDGs are dietary recommendations based on the existing consumption of locally available foods and aim to address identified nutrition-related public health problems. The FBDGs include a collection of short, positive, county-specific and science-based messages aimed to educate the general population on how to attain a prudent diet whilst simultaneously protecting the general public from the development of NCDs (Vorster *et al.,* 2001). Furthermore the FBDGs are practical, affordable, sustainable and culturally sensitive for South Africans over 7 years of age and will assist the public in choosing an adequate but practical diet.

In July 2003, the DOH adopted the FBDGs to form the core of Governments nutrition education messages with the aim of promoting healthy lifestyles among all South Africans. The South African FBDGs consist of 11 short, clear and simple messages which have been tested for comprehension, appropriateness and applicability in consumer groups of different ethnic backgrounds in both rural and urban areas (Vorster *et al.,* 2001).

The guidelines are:

- Enjoy a variety of foods.
- Be active.
- Make starchy foods the basis of most meals.
- Eat plenty of vegetables and fruits every day.
- Eat dry beans, peas, lentils and soya often.
- Chicken, fish, milk or eggs could be eaten daily.
- Eat fats sparingly.
- Use salt sparingly.
- Drink lots of clean, safe water.
- If you drink alcohol, drink it sensibly.
- Use foods and drinks containing sugar sparingly and not between meals.

The general population's awareness of major dietary recommendations is growing, but is still far from optimal and a significant gap between their nutritional knowledge and eating habits is still present. The most effective method of promoting healthy diets is an on-going debate; some other potential methods involve the identification of foods that are most likely to contribute towards healthy and unhealthy diets, i.e. '*healthy'* and *'unhealthy'* foods (Scarborough *et al.,* 2007).

2.4 Food choices and the association with non-communicable diseases

The increased prevalence of obesity and other chronic diseases of lifestyle world-wide and in South Africa (Steyn *et al.*, 2001) together with the WHO/FAO Diet, Nutrition and the Prevention of Chronic Diseases (2003) report, forced the nutrition community to address the concept of '*healthy'* and *'unhealthy*' foods in order to be able to assist the general public in making healthy food choices to prevent these diet related diseases (Wentzel-Viljoen *et al.,* 2010).

Some would argue that an individual food should never be described as *'healthy'* or *'unhealthy'* but for many applied reasons there is a need to do so. Early efforts at defining nutrient density agreed that nutritious foods should provide 'significant amount of essential

nutrients' but stopped short from providing actual standards and criteria (Drewnowski & Fulgoni, 2007). Nutrient-dense foods are still defined as foods that provide more nutrients and fewer calories (Drewnowski & Fulgoni, 2007). The notion of what constitutes as a 'healthy' food is constructed, in the first instance, around food groups (Drewnowski & Fulgoni, 2007). It should however be taken into account that not all foods in a food group have the same nutritional value and that foods within the desired food groups may still contain some of the undesired nutrients such as fats, sugars and sodium. Last mentioned, highlights the need for a method to identify the foods that are most likely to contribute towards a *healthy* and *unhealthy* diet.

2.5 Nutrient and health claims

In the last decade, health and the wellness of the general public has become an important issue within the food industry due to an increase in consumer demands for tastier and healthier food products (Ruffel, 2003). In addition, emerging science about the beneficial effects of certain foods and nutrients has come to light. The food industry has also invested resources for both improving the nutritional composition of processed food products as well as for the development of new food products with enhanced nutritional and health properties (Garsetti *et al.,* 2002). The emerging science about the beneficial effects of certain foods and nutrients to the consumers' health and the increased demand for healthier foods has created opportunities for the food industry to develop products with health benefits (Ruffell, 2003), which has resulted in food products making numerous nutrient and/or health claims being launched on the market.

South Africa has an active and growing food industry that is striving to provide for both the nutritional needs and wants of its consumers, whilst still remaining profitable (Wentzel-Viljoen *et al.,* 2010). In the last decade, health has become an important issue within the South African food industry. Subsequently plentiful food items making nutrient and/ or health claims have been launched (Wentzel-Viljoen *et al.,* 2010). This has created the need for the DOH, Directorate: Food Control to formulate regulations which will protect the consumer from misleading messages whilst not suppressing the economic growth of the food industry.

Many governments have introduced mandatory controls on food labelling to ensure that it provides consumers with meaningful and consistent information (Wentzel-Viljoen *et al.,* 2010). Governments have particularly sought to regulate the use of nutrient and/or health claims on food items. The Directorate: Food Control of the South African DOH aims to ensure, by means of scientifically founded legislation, auditing and information actions, that services provided to the public are based on the basic needs and the rights of the consumer

in order for the consumer to make informed choices without being misled. The mandate of the Directorate: Food Control *in terms of the labelling of foodstuffs is:*

- To inform consumers in order to make an informed decision when purchasing a foodstuff
- To protect the consumer from any misleading or deceptive practices which may affect the consumer in terms of his health
- To protect the food manufacturer.

2.6 Regulations governing the advertising and labelling of foodstuffs

The DOH published the draft Regulations Governing the Advertising and Labelling of Foodstuffs, No R. 642 for comments in the Government Gazette on 20 July 2007. One of the key objectives and fundamental principles behind the Regulations, are to promote healthier eating habits through improved labelling and advertising, thereby encouraging better food choices in order to improve public health by reducing the incidences of chronic diseases of lifestyle in the long term. This fundamental principle is in line with the FAO/WHO Global Strategy for Diet, Physical Activity and Health (Wentzel-Viljoen *et al.,* 2010).

One hundred and three (103) sets of comments were received on the draft Regulations from local and international stakeholders. There was general appreciation and support from most role players but it was also highlighted that several issues require further attention to enable the Directorate: Food Control, to finalise the draft Regulations based on sound scientific evidence.

The section widely commented on by the scientific community as well as the food industry, was *Annexure 6* which read: *"Foodstuffs not considered essential for a healthy diet and for which NO nutrient content, GI, certain comparative, health, slimming or any other claim with a health or nutritional message will be permitted".* This created the need to formulate a profiling system as a criterion for making nutrient and/or health claims which would protect consumers from misleading claims whilst not repressing economic growth and would satisfy stakeholders' demands for a scientific and evidence based approach.

2.7 Nutrient profiling

One of the most common uses of nutrient profiling in developed countries has been for food labelling schemes aimed at helping consumers to develop a greater understanding of the

nutrient composition of food items and – on the basis of that understanding - to identify food items that are healthier options (WHO, 2011).

Nutrient profiling has been involved in the regulation of nutrient and/or health claims in two ways. Firstly nutrient profiling has been used for setting qualifying criteria for nutrient and/or health claims, and secondly to create 'food quality indices' that aim to give an indication of the extent to which different foods contribute to dietary recommendations.

Differences in the energy density, nutrient content and costs between food groups has been widely reported (Combris *et al.,* 2011; Maillot *et al.,* 2007; Drewnowski *et al.,* 2004). Product composition variability within the same food categories have been investigated recently and the research has shown large variability in the sodium content of food items within the same food categories (Combris *et al.,* 2011; Ni Mhurchu *et al.,* 2011; Webster *et al.,* 2010). Nutrient profiles aim to benefit both the consumer and food manufacturers by ensuring that claims do not mask the overall nutrient content of food items and by encouraging food manufacturers to improve the nutritional quality of their food products and with this, levelling the playing field for all food manufactures (Wentzel-Viljoen *et al.,* 2012).

The ultimate aim of a nutrient profiling model is that it will help consumers to make healthier food choices and have 'healthier' diets which should eventually lead to a measurable improvement in the public health diet-related prevalence of NCDs in the country where it is implemented (Drewnowski & Fulgoni, 2007; Tetens *et al.,* 2007). Combris *et al.* (2011) reported that, with different scenarios of improvement of the nutrient composition within food categories, important improvements of 1 – 22% (increase the amount of fibre or decrease the amounts of sugars, fat and sodium) can be made by reformulating food products. The latter could lead to a potential improvement of the nutrient consumption of the consumers.

A recent study conducted in Europe (Trichterborn *et al.,* 2011) reviewed commercially available dairy products with nutrition or health-related claims on the packaging, against the selected nutrient profiling models. More than 300 products were identified and tested. The authors concluded that a nutrient profiling model that targets saturated fatty acids, sugars and sodium can meaningfully and comprehensively identify dairy products with a favourable nutritional composition.

Nutrient profiling cannot solve all the problems in relation to food and health due to the fact that the nutrient composition of individual foods is not the only determinant of diets. Nutrient profiling is also only concerned with the prudency of the diet and is thus focussed on; limiting the total energy intake (kJ), limiting highly processed foods, limiting salt and fried food

intake; limiting liquid energy intake (sugared drinks), limiting sweetened foods and increasing the fibre, vegetables and fruits intake. Nutrient profiling is however not concerned with the adequacy of the general public's diet. Diets are also determined by the portion sizes of individual foods that consumers eat, the frequency of their consumption, the variety of different foods which make up the diets and the combinations in which they are eaten (WHO, 2011).

2.8 The identification of a suitable nutrient profiling model for South Africa

It was necessary to investigate and research nutrient profiling as it is applied globally in order to address the debatable issue of Annexure 6 (No R. 642 of 2007) in a scientific and evidence - based approach. A report "Evaluation of existing Nutrient Profiling models" (Wentzel-Viljoen *et al.,* 2010) was completed as the first step towards the development, testing and evaluation of a suitable nutrient profiling model for South Africa.

A suitable nutrient profiling model would provide the DOH: Directorate Food Control with a scientific evidence-based approach to determine *the eligibility of a food item to carry a nutrient and/or health claim* and would address the most argumentative issue (Annexure 6) covered by the draft Regulation No R. 642 of 2007. It was recommended in the report that the Australian and New Zealand Nutrient Profiling Model (FSANZ) be used to determine the eligibility of food items in South Africa to carry any nutrient and/or health claim (Wentzel-Viljoen *et al.,* 2010).

The FSANZ model has been developed specifically as a tool for the regulation of health claims in Australia and New Zealand. The FSANZ model was based on a United Kingdom (UK) nutrient profiling model designed by Rayner and colleagues which was developed for the purpose of regulating the television advertising of food products to children (Food Standards Agency, 2009). Several modifications have been made by FSANZ to the original model in order to facilitate the assessment of a wide range of food products against the nutrient profiling model.

One of the reasons why the FSANZ model was based on the UK model was the agreement between the nutritional recommendations of the UK nutrient profiling model and the Reference Values for Australia and New Zealand (Wentzel-Viljoen *et al.,* 2012). South Africa is a Member State of the WHO and therefore follows the WHO guidelines. Table 1 indicates that all the recommendations are comparable and therefore the basis of both the UK and FSANZ model are in agreement with the guidelines used by South Africa for the prevention of chronic diseases. The FSANZ model is thus based on the prudency of the diet.

Table 1: Comparison between the nutritional recommendation for the UK Nutrient Profiling Model, Reference Values for Australia and New Zealand for moderately active woman and the WHO guidelines used in South Africa

Nutrient	Recommendations for UK Nutrient Profiling Model (Rayner *et al.,* 2009)	Australian and New Zealand Reference values, based on a Moderately active woman (19-50years)	WHO: Ranges of population nutrient intake goals (based on 8300kJ diet)*
Energy	2130 kcal (8916kJ) Weighted average of the EAR for boys and girls in the 11-14 and 15-18 year age bands	8750kJ Based on: median height for adult women in the 1995 Australian National Nutrition Survey was 161.4cm. At BMI=22 and a PAL of 1.6, this yields and EAR of 8700 – 800kJ per day	To maintain a healthy weight
Saturated Fat	11% of energy (26g)	10% energy (26g) (Australia); 12% energy (New Zealand)	<10% of total energy (20g)
Total Sugar	21% of energy Non-milk extrinsic sugar: 11% of energy	No nutrient reference values The Australian Dietary Guidelines comment that there is no evidence that 15-20% energy from sugars is incompatible with a healthy diet; The New Zealand Dietary Guidelines suggest no more that 15% of total energy should be derived from sucrose and free sugars	<10% free sugars (all monosaccharide's and disaccharides added to food by the manufacturer, cook of consumer, plus sugars naturally present in honey, syrups and fruit juices)
Sodium	2400mg Based on the RNI of 1600mg/day multiplied by 1.5 to achieve consistency with the UK Scientific Advisory Committee on Nutrition recommendation of 2400mg	UL = 2300mg	<2000mg
Protein	RNI rounded to nearest 5 (45g for woman)	RDI = 46g	10-15% of total energy
Fibre	20-24g The amount specified by COMA (18g) for a daily faecal weight of at least 100g was based on the Englyst method; this was converted to the equivalent using AOAC method	AI = 25g	>25g per day total dietary fibre
Fruit and Vegetables	50% increase in consumption is recommended which would give a total of 380g/day (excludes potato which is classified as bread)	Australia recommendations: 300g fruit; 375g vegetables (including potatoes) (Australia): no equivalent recommendation for New Zealand	≥400g per day (South African Food Based Dietary Guidelines > 400g)

*WHO. 2003. Diet, nutrition and the prevention of chronic diseases

AI = Adequate Intake
AOAC = Association of Official Analytical Chemists
BMI = Body Mass Index
COMA = Committee Medical Aspects of Food & Nutrition Policy
EAR = Estimated Average Intake
PAL = Physical Activity Level
RDI = Recommended Dietary Intake
RNI = Reference Nutrient Intake
UL = Upper Limit

2.9 The FSANZ nutrient profiling model

The FSANZ model considers the energy, saturated fat, sodium and sugar content of food products while recognising the role of lean meat, dairy products, fish, fruit, vegetables and nuts and unsaturated fats as important components of a healthy diet.

- Points are allocated based on the nutrient composition per 100g/100mL of each food item.
- The allocation of baseline points is based on the energy, saturated fat, total sugar and sodium content of the food item, these are the disqualifying nutrients.
- The modifying points are calculated taking into consideration certain conditions, the vegetable (V), protein (P) and fibre (F) points are obtained from the amount (percentage) of fruit and vegetables (including nuts and legumes), and from the fibre and protein content of the food item.
- Certain conditions are also build into the model, for example 'if a food or beverage scores eleven (11) points or more for the baseline, then the food item cannot score any points for protein, unless the item also scores the maximum number of points for fruits, vegetables, legumes and nuts'.

A food item's *eligibility to carry a nutrient and/or health claim* will be determined by the following pieces of nutritional information in order to calculate the baseline points and the V, P and F points.

In order to calculate the baseline points and the protein (P) and fibre (F) points the quantity of the following nutrients per 100g/100mL of the food item will be required:

- average energy (kilojoules);
- average saturated fat (g);
- average total sugars (g); and
- average sodium (mg).
- average protein (g); and
- average dietary fibre (g).

To calculate the V points the quantity of the following characteristics of the food item will be required:

- percentage of the non-concentrated fruit, vegetable, legumes and nuts (fvln); and
- percentage of the concentrated (dried) fruit and-, vegetable ingredients; and
- percentage of non-fvln ingredients of the food product.

*Due to low moisture content, nuts, legumes, coconut, spices, herbs, fungi, seeds and algae are classified as non-concentrated and therefore 'concentrated (dried)' refers only to fruit and vegetables rather than fvln.

The food item's final score will be the indication of a products *eligibility to carry a nutrient and/or health claim.*

Final score = baseline points – (V points) – (P points) – (F points)

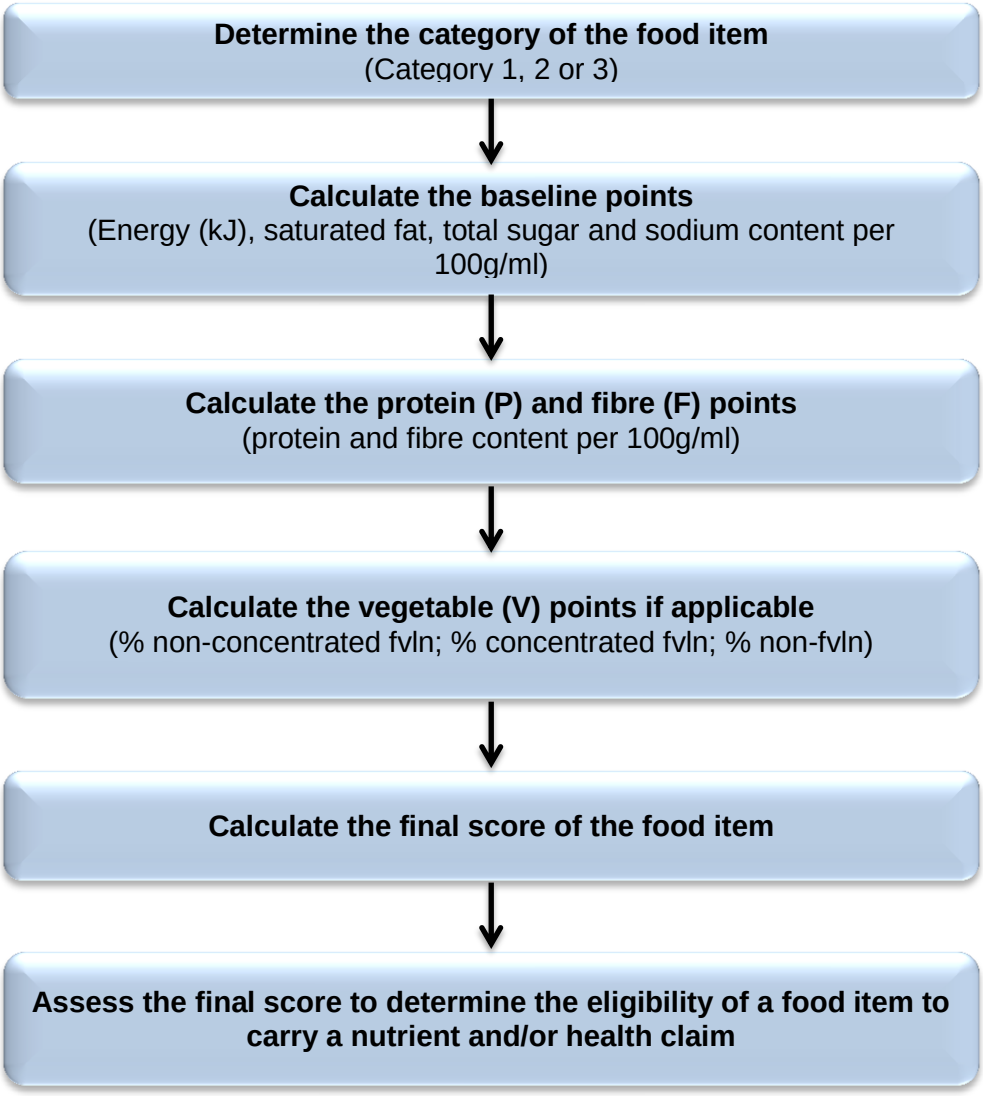

Figure 1: Steps to determine if a food item meets the scoring criteria

Determining the category and scoring criteria of a food item

Table 2 is used to determine the nutrient profiling category and scoring criteria of a food item, this is a critical step in the final score and thus the *eligibility to carry a nutrient and/or health claim* of a food item.

Table 2: Food item categories and scoring criteria

Category	Food items included	Scoring criteria
Category 1	• Beverages (excluding milk)	final score **< 1** total points: Meets scoring criteria to carry a health claim
Category 2	• Foods other than those included in category 1 or 3; and • Milk, evaporated milks or dried milks.	final score **< 4** total points: Meets scoring criteria to carry a health claim
Category 3	• Cheese and processed cheese with calcium content > 320mg/100g • Edible oil • Edible oil spreads • Margarine • Butter	final score **< 28** total points: Meets scoring criteria to carry a health claim

- All other cheeses with a calcium content ≤ 320mg/100g are classified as a category 2 product.

Table 3 provides examples of food item classifications by the nutrient profiling model software developed on excel for the testing and validation of the suitable model. Food items from the three food categories are included, the baseline, P, F and were applicable V points were calculated in order to determine the final score and thus the eligibility of the food items to carry a nutrient and/or health claim.

Table 3: Examples of food item classification by the nutrient profiling model

Food item	Food item category	Average energy content (kJ)		Saturated fatty acids (g)		Total sugars (g)		Sodium (mg)		Baseline points	% concentrated fvln		% fvln		Protein (g)		Fibre (g)		Final score	Eligible for claim
		/100g	Point	/100g	Point	/100g	Point	/100g	Point		value	Point	value	Point	/100g	Point	/100g	Point		
Margarine, hard brick	Category 3	2975	8	14.33	14	0	0	802	8	30		0		0	0.2	0	0	0	30	NO
Margarine, low fat, polyunsaturated	Category 3	1346	4	6.87	6	0	0	850	9	19		0		0	2	1	0	0	19	YES
Corn Flakes	Category 2	1604	4	0.03	0	6.3	1	1211	10	15		0		0	7.7	4	3.3	3	8	NO
Cereal Whole Wheat Biscuits	Category 2	1555	4	0.27	0	6.2	1	165	1	6		0		0	11.6	5	12.1	5	-4	YES
Iced tea, light	Category 1	4	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	YES
Fruit juice, orange	Category 1	227	0	0	0	4.8	1	1	0	1		0	30	0	0.7	0	0.1	0	1	NO

Fvln = fruits, vegetables, legumes and nuts

2.10 The validation of a nutrient profiling model

Nutrient profiling models are designed to score the 'healthiness' of food items and can therefore be viewed as 'instruments' similar to for example those used to score the quality of life of patients with a particular disease (Arambepola *et al.,* 2007). Therefore, nutrient profiling models should be subject to reliability and validity testing.

Validation is a vital step in the development of a nutrient profiling model, as it ensures that the final model is based on sound scientific principles and therefore that interventions that utilise the nutrient profiling model is evidence based (WHO, 2011). Without proper validation, any model would be questioned by nutrition scientists and the food industry.

The WHO developed the 'Guiding principles and framework manual for the development or adaptation of nutrient profile models' (WHO, 2011). The aim of this document is to set out guiding principles and practical advice about nutrient profiling. The document seeks to help organisations and institutions, such as government ministries and agencies, food producers and retailers, as well as non-governmental organisations concerned with food and health issues, develop or adapt nutrient profiling models for specific applications within countries and regions (WHO, 2011). The guidelines describes a range of approaches to use in the validation process of a nutrient profiling model, which would all aid in the development, consistency and credibility of the selected nutrient profiling model. The validity testing has various aspects; the validation approaches discussed in the guidelines (WHO, 2011) include a range of different validation tests.

- Content validity – this is defined as 'the extent to which the measurement incorporates the domain of the phenomenon under study' (Last, 2001).
- Convergent validity – this is defined as 'the extent to which the measurement correlates with an external criterion, of the phenomenon under study, at the same point in time' (Last, 2001). Arambepola *et al.* (2007) referred to convergent validity as the comparison with other measures (not necessarily better ones) of the same variable or a closely related one.
- Discriminant – is the comparison with measures of variables that are not closely related (Arambepola *et al.,* 2007).
- Construct validity – is defined as 'the extent to which the measurement corresponds to theoretical concepts (constructs) concerning the phenomenon under study (Last, 2001).
- Predictive validity - is defined as 'the extent to which the measurement is able to predict an external criterion of the phenomenon under study' (Last, 2001).

The validation processes described in the guideline (WHO, 2011) largely falls in to one of two categories:

- Ensuring the credibility of the classification of food items produced by a nutrient profiling model and,
- Assessing the role of the 'healthiness' of food items in maintaining human health.

The first set of validation approaches is concerned with ensuring that a nutrient profiling model produces accurate, consistent and credible classifications of food items. The WHO, 2011 report classifies the first set of validation approaches as the main concern of developers of the nutrient profiling model and motivates that all of these validation processes be attempted for all newly developed or adapted nutrient profiling models.

The first set of validation approaches recommended for all new or adapted nutrient profiling models are to:

- Identify a small number of 'indicator' foods and assess whether the nutrient profiling models produces results which appear to contradict the FBDGs. This is usually done during the development of the nutrient profiling model. This is a weak assessment of validity, and is primarily used to identify whether there are any obvious anomalies that might affect the credibility of the nutrient profiling model. This is a type of 'content validity' assessment (WHO, 2011).
- Develop a representative dataset of foods with nutrient composition data. Rank the foods in this dataset in order of healthiness in accordance with the views of a sample of nutrition experts. Compare the classification from the nutrient profiling model with this ranking. This measures whether the nutrient profiling model is in accordance with the views of nutrition experts, and is a reasonably strong form of validation. This is a type of 'convergent validity' assessment (WHO, 2011). .
- Compare results using the new model with those from other models that have previously been validated. This kind of comparison provides evidence of 'convergent validity' (WHO, 2011). .

The second set of validation processes are more complex approaches and is more appropriate for validating the concept of nutrient profiling, in terms of assessing the role that the 'healthiness' of food items have in human health (WHO, 2011).

Validation approaches aimed at reinforcing the concept of nutrient profiling include:

- Using dietary survey data to calculate the proportion of the respondents' diet that consist of healthy and unhealthy foods, as classified by the nutrient profiling model. The respondents are then split into groups on the basis of dietary quality. The average proportion of the diet that is made up of healthy food is compared across dietary groups, with the expectation that healthier diets consist of a greater proportion of health foods. This is a reasonably strong form of validation, testing this relationship is an assessment of 'construct validity' (WHO, 2011).
- Constructing a theoretical healthy (or unhealthy) diet using nutrient recommendations. A large nutrient composition dataset of foods which have been classified by a nutrient profile model can be used to calculate whether it is possible to construct the theoretical healthy diet using only foods that are healthy, or only foods that are unhealthy. It is expected that the former is possible but the latter is not. This is a reasonably strong form of validation, and is again a test of construct validity, where the constructs under test are 'healthy foods make healthy diets' and 'unhealthy foods make unhealthy diets' (WHO, 2011).
- Using suitable prospective cohort data with baseline information on food consumption. The cohort can be split into groups on the basis of the proportion of their diet that consists of healthy foods (as defined by the nutrient profiling model). The follow-up data can be used to calculate the incidence rates of diet-related diseases in the different groups, with the expected result that the group that consumed a larger proportion of healthy foods at baseline have a reduced risk of diet-related diseases. This kind of validity assessment is known as 'predictive validity', this is considered a very strong measure of the validity of a tool, such as the NPM (WHO, 2011).

The literature reviewed in this literature study supports the use of a NPM as an objective and scientific tool to assess the eligibility of a food item to carry a nutrient and/or health claim, and indicated the importance of a proper validation process. The literature with regards to the validation of a NPM is however limited.

The DOH, Directorate: Food Control decided to proceed with the finalisation of the Food Labelling and Advertising Regulations in two phases. The first phase was the new Regulations Related to Labelling and Advertising of Foodstuffs (R.146) published on the 1st of March 2010. The second phase related to the further regulation of the labelling of foodstuffs (nutrient and/or health claims) by the Department, this depended greatly on the development or adaptation of suitable and applicable NPM for South Africa.

Wentzel-Viljoen and researchers (2010) recommended that the Australian and New Zealand Nutrient Profiling Model (FSANZ, 2008) be used to determine the eligibility of food items in South Africa to carry any nutrient and/or health claim. The 'Guiding principles and framework manual for the development or adaptation of nutrient profiling models' (WHO, 2011) was used as the guide for the adaptation of the FSANZ model. The validation approaches concerned with ensuring that the NPM produces credible classifications of food items was the first validation approaches used by the researchers and are the validation approaches that will be discussed in this dissertation.

2.11 Validation approaches used for this dissertation

The first approach to the validation of a NPM as described in the guiding principle manual (WHO, 2011) is to compare the classification of 'indicator' food items with the FBDGs. This is a type of content validity testing. Content validity testing is usually done during the development of the NPM and is a fairly weak form of validation. The results of this comparison are used to identify whether the results obtained by the model are generally in agreement with the FBDGs, and to identify whether there are any obvious anomalies that might affect the credibility of the NPM (WHO, 2011).

The second approach to the validation of a NPM is to compare the classification of food items by the NPM with the ranking of food items by nutrition experts. This is a type of convergent validity testing. Comparison with other measures - not necessarily better ones – of the same variable or a closely related one is called testing for convergent validity (Arambepola *et al.,* 2007). Such an assessment of validity has two main advantages over the simple method of using 'indicator' foods and comparing it to the FBDGs. Firstly, if the representative sample of foods covers the entire spectrum of foods, then this will allow quantification of the extent of agreement between the NPM and the views of nutrition experts. Secondly, the views of nutrition experts will be gathered without prior knowledge of the classifications of food items by the NPM, their views will thus not be influenced by the NPM under investigation.

2.12 Assumptions

It was necessary to make certain assumption in order to validate the NPM.

2.12.1 Total sugar

The amount of total sugar in grams is required by the NPM to calculate the baseline score. FSANZ defines the sugar as total sugar including all mono- and disaccharides, added as

well as intrinsic sugars such as lactose and fructose. The Condensed Food Composition Tables of South Africa (Wolmarans *et al.,* 2010) provide the added sugar amount in g/100g. Added sugar is defined as mono- or disaccharides added to food and do not include sugars naturally present in the food such as lactose in milk and fructose in fruits. For the purpose of this study, the sugar component of the NPM is defined as added sugars as indicated in the food composition tables as well as on the nutritional information panel of food stuffs.

2.12.2 Fruit, vegetable, legume and nut content

Food items that did not display any information with regard to the percentage of fruit, vegetables, legumes and nuts (% fvln or % concentrated fvln) on the nutritional information panel, the assumption was made that the food item did not contain any fruits, vegetables, legumes or nuts.

2.12.3 Accuracy of nutritional information panel

It was also assumed that the nutritional information panel displayed on food items and the nutritional information provided in the Condensed Food Composition Tables of South Africa (Wolmarans *et al.,* 2010) were a true representation of the actual nutrient composition.

In the following chapters of this mini-dissertation the content validity (Chapter 3) and convergent validity (Chapter 4) of the suitable NPM, according to the first set of validation approaches of the WHO guiding principles (WHO, 2011) will be investigated. The collective conclusion and recommendations of both the validation approaches will be discussed in the closing chapter (Chapter 5).

CHAPTER 3

3. CONTENT VALIDITY

3.1 Introduction

The first approach to the validation of a NPM as described in the 'Guiding principles and framework manual for the development or adaptation of nutrient profile models' (WHO, 2011) is to compare the classification of food items with the FBDGs. This is usually done during the development of the NPM and is the first method of validation. This is a type of content validity which is defined as 'the extent to which the measurement incorporates the domain of the phenomenon under study' (Last, 2001). Content validity testing is only a weak form of validation, but it is primarily used to identify whether there are any obvious anomalies with the classification food items by the NPM that might affect the credibility of the NPM.

3.2 Aim

The aim of this method of validation is:

- To identify a small number of 'indicator' foods and to assess whether the NPM produces results which appear to contradict the FBDGs.

3.3 Methodology

3.3.1 Food products selection

In order to ensure that the food products included in this study is a true representation of foods that are frequently consumed by South Africans and representative of all the food groups readily available in South Africa, food items included were identified as follows:

- Food products mentioned or visually illustrated in the FBDGs booklets and pamphlets and
- Food products carrying any nutrient and/or health claim.

The food groups were based on the food composition chapters of the Condensed Food Composition Tables for South Africa (FCTSA) (Wolmarans *et al*., 2010) with the exclusion of Group 14 (Baby Foods) and Group 15 (Therapeutic/Special and Diet Products). The Therapeutic/Special and Diet products group (Group 15) was excluded as these products

were not included in the draft food labelling Regulations of 2007 (No R.642). It was decided to exclude the baby foods group as research on baby foods and the labelling of these products are currently being conducted. A miscellaneous food group was included in order to include food products mentioned in Annexure 6 (Addendum A) as stipulated in the draft Regulations Governing the Advertising and Labelling of Foodstuffs, No R.642 published for comments in the Government Gazette on 20 July 2007. The miscellaneous group included food items such as fruit juices, ice teas, biscuits, candies, chocolates and confectionary, savoury foodstuffs, dried soup powders, "health bars", "candy breakfast cereals" and syrups. A total number of 10 food items were included into the miscellaneous group that was not yet included into the other food groups.

Table 4: Food group categorisations

Food Group	Food Products
Group 1	Cereals and Cereal Products (A wide variety of foods are included in this group, e.g. cakes, pastries, breads, rice, pastas, porridges ex.)
Group 2	Vegetables
Group 3	Fruit
Group 4	Legumes and Legume Products
Group 5	Nuts and Seeds
Group 6	Milk and Milk Products
Group 7	Eggs
Group 8	Meat and Meat Products
Group 9	Fish and Sea Food
Group 10	Fats and Oils
Group 11	Sugar, Syrups and Sweets
Group 12	Soups, Sauces, Seasonings and Flavourings
Group 13	Beverages
Group 16	Miscellaneous

Food items, both with ("YES") and without ("NO") the potential eligibility to carry a nutrient and/or health claim according to the NPM classification were included in the selection process. A "YES" would indicate that the food item meets the NPM classification and will thus be classified as *eligible to carry a nutrient and/or health claim.* A "NO" would indicate that the food item does not meet the NPM classification and will be classified as an item *not eligible to carry a nutrient and/or health claim.* For example the FBDGs urges the public to

"use foods and drinks containing sugar sparingly and not between meals", food items (n=15) from the sugar, syrups and sweets group were included in order to determine the level of agreement between the NPM and the FBDGs.

3.3.2. Data collection

Nutritional information was sourced from the nutritional information panel of various food products (n=135) carrying a nutrient and/or health claim in a range of grocery stores in and around Gauteng and the North-West province of South Africa.

A claim in relation to foodstuff was considered as any written, pictorial, visual or descriptive statement brought to the attention of the public in any manner on the food item. A health claim was considered as a claim that a food item (or its components) is related to the health of the consumer of that food item for example 'good for your heart' and 'aids in digestion'. A nutrient claim was considered as a claim made about the levels of nutrients in a food item for example 'low fat' or 'source of fibre'.

Nutritional information was gathered from the FCTSA in cases were the food item did not display any nutritional information on the nutrition information panel for example foods items in the meat, vegetable and fruit groups.

The following nutritional information (table 5) was collected from the selected food products from all the food groups indicated in table 4.

Table 5: Nutritional information gathered from food products

Food product
Food name
Manufacturer
Nutrient or health claim
Origin of nutritional information (Product label/ FCT)
Serving size (g)
Nutrient profiling category (as discussed in table 2)
Energy (kJ per 100g/mL)
Total fat (g per 100g/mL)
Saturated fat (g per 100g/mL)
Total sugar (g per 100g/mL)
Protein (g per 100g/mL)
Fibre (g per 100g/mL)

Sodium (mg per 100g/mL)
Percentage concentrated fruit, vegetables, legumes and nuts
Percentage fruit, vegetables, legumes and nuts

The nutritional information of 209 food items was collected from the FCTSA and 135 food items carrying a nutrient and/or health claims' nutrition information panels. In total 344 food items' nutritional information was gathered to form the final master list.

The 'indicator' foods were carefully chosen by making use of the FBDGs booklet and pamphlets, any food item mentioned or visually illustrated in the booklet or pamphlets was selected to form part of the 'indicator' food list (n=131). A total number of 131 'indicator' foods were selected from the master list to be classified by the NPM and compared to the FBDGs with the aim of defining the level of agreement in food item classification.

3.3.3 Food product classification

In order to proceed with the most argumentative issue (Annexure 6) covered by the Draft Regulations on labelling of foodstuffs (No R. 642 of 2007), it was necessary to investigate and research nutrient profiling as it is applied globally. It was also considered necessary to develop a suitable NPM that can address the intention and purpose of Annexure 6 effectively and which is based on a sound and scientific evidence-based process.

A report: "Evaluation of existing nutrient profiling models" was conducted by the North West University in January 2010 as the first step in the development, testing and evaluation of a suitable and applicable NPM for South Africa. Such a model would provide the Department of Health: Directorate Food Control with a scientific evidence-based approach to determine the eligibility of a food item to carry a nutrient and/or health claim. The report recommended that the Australian and New Zealand Nutrient Profiling Model (FSANZ) be used to test the eligibility of food items in South Africa to carry any nutrient and/or health claim (Wentzel-Viljoen *et al.,* 2010).

An excel software programme was developed based on the FSANZ model, as discussed in the literature review (Chapter 2). The software programme was used to calculate the final score of each of the 'indicator' foods according to their specific NPM food category. The final score of the 'indicator' food item determined the eligibility of each 'indicator' food to carry a nutrient and/or health claim. A total number of 131 'indicator' food items' (Addendum B) nutritional information was read into the NPM and classified according to the applicable NPM food category.

A “YES” would indicate that the product meets the NPM classification criteria and *is eligible to carry a nutrient and/or health claim* and a “NO” would indicate that the food product does not meet the NPM classification criteria and is *not eligible to carry a nutrient and/or health claim*.

The food item’s NPM classification was then compared to the classification of the same food item according to the FBDGs. In July 2003, the DOH adopted the FBDGs to form the core of the Governments’ nutrition education messages with a view of promoting healthy lifestyles among all South Africans.

The South African FBDG’s consist of 11 short, clear and simple messages which have been tested for comprehension, appropriateness and applicability in consumer groups of different ethnic backgrounds in both rural and urban areas (Vorster *et al.,* 2001). The FBDGs motivates regular consumption of starches, vegetables and fruits, legumes, meats, chicken, fish, eggs and milk products. The FBDGs also recommends consuming sugary foods and beverages, salty foods and fats sparingly.

It was therefore postulated that foods categorised by die NPM as “YES” should be found more frequently within foods categorised by the FBDGs as ‘starches’, ‘vegetables and fruits’, ‘legumes’ and ‘chicken, meat, fish, milk or eggs’. Foods categorised by the NPM as “NO” should be found more frequently within the foods categorised by the FBDGs as ‘fats’ , ‘sugary foods’ and ‘salty foods’. For example the FBDGs states “Eat dry beans, split peas, lentils and soya regularly”. A soya mince product is thus expected to be promoted by the FBDGs as a healthy product and would then be expected to be classified as a “YES” item by the NPM.

Food items visually illustrated in the FBDGs booklet guidelines on starches, vegetables and fruits, legumes and meat products were all classified as “YES” items. Food items visually illustrated in the guidelines on salt and sugar were all classified as “NO” items as the consumption of these items were all discouraged by the FBDGs. The food items visually illustrated in the FBDG booklet on fats were all classified as “YES” items as the consumption of these items were all promoted by the guideline.

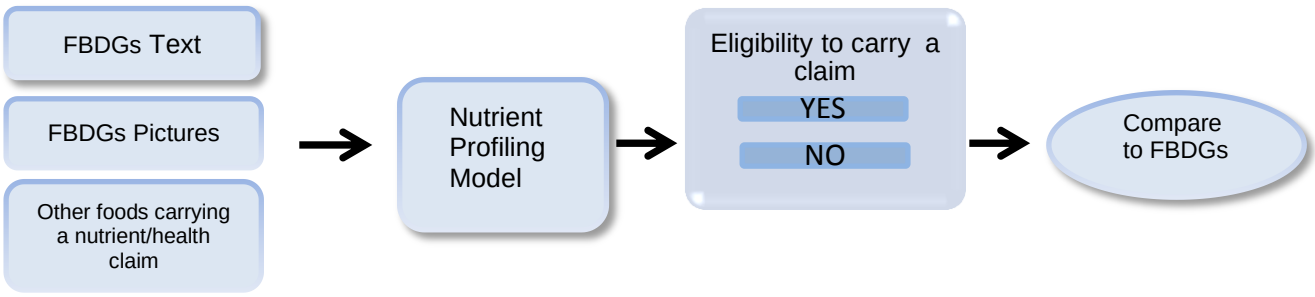

Figure 2: Food product selection and classification process

3.3.4 Data analysis

Statistical analysis was done by measuring the level of agreement (kappa statistic) between the NPM classification and the FBDGs classification of food items. Kappa statistic is intended to give the reader a quantitative measure of the magnitude of agreement between observers; it is thought to be a more robust measure than simple percentage agreement calculations since the kappa statistic takes into account the agreement occurring by chance.

A kappa statistic of 1 indicates perfect agreement, whereas a kappa statistic of 0 indicates agreement equivalent to chance. The interpretation of kappa statistics according to Landis and Koch (1977) is indicated in table 6.

Table 6: Interpretation of the kappa statistic

Kappa statistic	Agreement
< 0	Less than chance agreement
0.01 – 0.20	Slight agreement
0.21 – 0.40	Fair agreement
0.41 – 0.60	Moderate agreement
0.61 – 0.80	Substantial agreement
0.81 – 0.99	Almost perfect agreement

3.4 Results

The software programme developed on Exel, based on the NPM, was used to calculate the final score of each of the 'indicator' foods (n=131) in order to determine the eligibility of a food item to carry a nutrient and/or health claim.

A "YES" for the NPM classification indicates that the food item meets the criteria of the NPM and will thus be eligible to carry a nutrient and/or health claim. A "YES" for the FBDG classification indicates that the consumption of a food item is promoted by the FBDGs. A "NO" for the NPM classification indicates that the food item does not meet the criteria of the NPM and will thus not be eligible to carry a nutrient and/or health claim. A "NO" for the FBDG classification indicates that the consumption of a food item is discouraged by the FBDGs.

Each of the 'indicator' food items was classified by the NPM according to the applicable NPM food category (Table 2), as discussed in the literature review (Chapter 2), in order to

determine the final score and determine the eligibility of a food item to carry a nutrient and/or health claim. The applicable NPM food category and final score of each 'indicator' food is however not indicated in table 7. The total number of 'indicator' food items classified as "YES" or "NO" by the NPM and the total number of 'indicator' food items classified as "YES" or "NO" by the FBDGs is shown in table 7.

Table 7: Number of food items classified by the NPM as 'eligible' and 'not eligible' to carry a nutrient and/or health claim and the corresponding FBDGs classification

Food Based Dietary Guideline	Number of food items classified	Food item classification	NPM classification	FBDG classification
Chicken, milk, meat or fish could be eaten daily	n = 25	YES total	15 (60%)	21 (84%)
		NO total	10 (40%)	4 (16%)
Eat dry beans, split peas, lentils and soya regularly	n = 14	YES total	10 (71.4%)	14 (100%)
		NO total	4 (28.6%)	0 (0%)
Make starchy foods the basis of most meals	n = 17	YES total	13 (76.4%)	14 (82.4%)
		NO total	4 (23.6%)	3 (17.6%)
Eat plenty of vegetables and fruits daily	n = 21	YES total	19 (90.4%)	21 (100%)
		NO total	2 (9.6%)	0 (0%)
Use food and drinks containing sugar sparingly and not between meals	n = 15	YES total	0 (0%)	0 (0%)
		NO total	15 (100%)	15 (100%)
Use salt sparingly	n = 16	YES total	0 (0%)	0 (0%)
		NO total	16 (100%)	16 (100%)
Eat fats sparingly	n = 23	YES total	10 (43.5%)	8 (34.8%)
		NO total	13 (56.5%)	15 (65.2%)

Table 7 demonstrates that 90.4% of the vegetables and fruits, 71.4% of the legumes and 76.4% of the starchy foods as categorised by the FBDGs are classified as "YES" by the

NPM. The FBDGs promotes the consumption of these food items. Table 7 also illustrates that 0% of the sugary foods, 0% of the salty foods and 43.5% of the fats are classified as "YES" by the NPM. These food items are all recommended to be used sparingly by the FBDGs.

The level of agreement (kappa statistic) between the NPM and the FBDGs in the classification of the 'indicator' food items is shown in table 8. Table 8 indicates the number of 'indicator' food items that had a similar NPM and FBDG classification in each of the food groups according to the FBDGs. The number of food items that were classified differently by the NPM and FBDGs is also indicated in table 8.

Table 8: The agreement between the FBDGs classification and the NPM classification of 'indicator' foods according to the FBDGs of South Africa

Food Based Dietary Guideline	NPM Classification	FBDG Classification		Agreement
Chicken, milk, meat or fish could be eaten daily		No. 'indicator' foods YES	No. 'indicator' foods NO	kappa statistic = 0.44 Moderate agreement
	No. 'indicator' foods YES	15	0	
	No. 'indicator' foods NO	6	4	
Eat dry beans, split peas, lentils and soya regularly		No. 'indicator' foods YES	No. 'indicator' foods NO	kappa statistic= 0.714 Substantial agreement
	No. 'indicator' foods YES	10	0	
	No. 'indicator' foods NO	4	0	
Make starchy foods the basis of most meals		No. 'indicator' foods YES	No. 'indicator' foods NO	kappa statistic = 0.734 Substantial agreement
	No. 'indicator' foods YES	13	0	
	No. 'indicator' foods NO	1	3	
Eat plenty of vegetables and fruits daily		No. 'indicator' foods YES	No. 'indicator' foods NO	Almost perfect agreement
	No. 'indicator' foods YES	19	0	
	No. 'indicator' foods NO	2	0	
Use food and drinks containing sugar sparingly and not between meals		No. 'indicator' foods YES	No. 'indicator' foods NO	Almost perfect agreement
	No. 'indicator' foods YES	0	0	
	No. 'indicator' foods NO	0	15	
Use salt sparingly		No. 'indicator' foods YES	No. 'indicator' foods NO	Almost perfect agreement
	No. 'indicator' foods YES	0	0	
	No. 'indicator' foods NO	0	16	
Eat fats sparingly		No. 'indicator' foods YES	No. 'indicator' foods NO	kappa statistic = 0.638 Substantial agreement
	No. 'indicator' foods YES	7	3	
	No. 'indicator' foods NO	1	12	

Number (No.), nutrient profiling model (NPM), food based dietary guideline (FBDG)

A substantial agreement was present in the way that the NPM and FBDGs categorises food items in the legume, starches and fats groups. There was an almost perfect agreement in the vegetable and fruits, sugary foods and beverages and salty foods groups' classification. A moderate level of agreement was present in the chicken, fish, milk, meat and egg group.

Table 9: Overall agreement between the FBDGs and the NPM classifications

	No. of 'indicator' foods classified "YES" by FBDGs	No. of 'indicator' foods classified "NO" by FBDGs	Agreement
No. of 'indicator' foods classified "YES" by NPM	64	3	Kappa statistic = 0.73 Substantial agreement
No. of 'indicator' foods classified "NO" by NPM	14	50	

Number (No.), nutrient profiling model (NPM), food based dietary guidelines (FBDGs)

The overall agreement between the way that the NPM classifies food items and the classification of the same food items by the FBDGs was substantial (kappa statistic = 0.73) as indicated in table 9.

3.5 Discussion

This chapter described the outcome of testing for content validity in a suitable NPM for South Africa. The aim of this validation was to identify a number of 'indicator' foods and assess whether the NPM produces results which appear to contradict the South African FBDGs.

The FBDGs can be used as a consistent communication tool as well as the basis in planning, implementation and evaluation of public health nutrition strategies as it represents expert agreement on how diet-related public health problems should be addressed (Vorster *et al.,* 2001).

The NPM classification of food items was compared to the FBDGs classification of food items mentioned or visually illustrated in each of the guidelines stated in the FBDGs booklet.

3.5.1 The overall agreement between the NPM classification and FBDG classification of 'indicator' food items

Testing for the content validity of the NPM shows that it does categorise foods in a way that corresponds with that of the FBDGs (kappa statistic = 0.73).

Arambepola *et al.* (2007) also tested for the content validity of a nutrient profiling model WXYfm and compared the way that model WXYfm categorises foods to the Balance of Good

Health (BGH). The BGH is the United Kingdoms' (UK) national food guide. It is a pictorial representation of the recommended balance of foods in the diet (HEA, 1994). The BGH is a pie chart where the size of the segments signifies the amount of food that should be eaten from each food group. The BGH directs people to eat *lots of* foods from 'fruits and vegetables', 'bread, other cereals and potatoes'; *intermediate amounts* of foods from 'milk and dairy foods', 'meat, fish and alternatives'; and 'fatty and sugary foods' *sparingly* (Arambepola *et al.,* 2007). Arambepola *et al.* (2007) found the level of agreement between Model WXYfm and the BGH in categorising foods also to be substantial (kappa statistic = 0.69).

It can thus be concluded from these results that nutrient profiling has the ability to categorise food items in a way that is clearly related to a well-established representation of a healthy diet: as presented by the FBDGs in South Africa and BGH in the United Kingdoms.

3.5.2 Comparing the NPM classification to each of the FBDGs

3.5.2.1 FBDG: Meat, chicken, fish, milk and eggs could be eaten daily

There is a moderate level of agreement (kappa statistic = 0.44) between the FBDGs and the NPM classification of food items categorised in this guideline (n=25).

Food items that were classified as ***not*** *eligible to carry a nutrient and/or health claim* by the NPM were the processed, high fat and fried meats. The high amount of saturated fats and sodium in these products were the main disqualifying components. The FBDG on meat products also discourages the use of processed, high fat and fried meats due to the sodium and fat content of these items.

The only inconsistency in food item classification by the FBDGs and the NPM was with the powdered milk (full cream and low fat), cheese, beef chuck, tinned sardines (in brine) and frozen fish fingers. The high amount of saturated fat and sodium in these food items were the disqualifying factors. It was also discovered that similar food items produced by different manufacturers had different sodium contents. For example, fish fingers produced by a certain manufacturer were classified as *eligible to carry a nutrient and/or health claim* by the NPM whereas fish fingers produced by a different manufacturer were disqualified from making any nutrient and/or health claims by the NPM. Combris and co-workers (2011) recently reported on the large variability in the sodium content of food items within the same food category.

The strongest argument for including foods from animal sources into the FBDGs is that these foods are exceptional sources of essential micronutrients such as iron, zinc, calcium, B vitamins and omega-3 fatty acids (Scholtz *et al.,* 2001). Research however indicates that the overconsumption of animal-derived foods, especially high fat products and red meat, could increase the risk of developing several chronic diseases (Scholtz *et al.,* 2001). The FBDGs of South Africa does however recommend that 'fats should be eaten sparingly', and in order to comply with this guideline low-fat or lean meats should be chosen. The FBDGs also urges the public to 'use salt sparingly' as strong evidence points to the validity of restricting salt intake to lower blood pressure (Charlton & Jooste, 2001). One method of reducing sodium intake is by limiting the amount of salt added to foods during cooking and at the table, but Charlton and Jooste (2001) reported in the FBDGs support papers that certain food items such as processed foods, tinned foods, cheese and certain snacks also contains substantial amounts of salt. It was also reported by these authers that all-inclusive labelling will allow the consumer to select low-salt products, or limit the intake of processed foods with high-salt content. It should however be kept in mind that not all consumers have the ability to read and correctly interpret nutritional information panels.

The NPM considers the energy, saturated fat, sodium and sugar content of food items, whilst recognising the role of lean meat, dairy products, fish, fruit, vegetables and nuts and unsaturated fats as important components of a healthy diet. The NPM classification of a food item is thus based on the total composition of a food item and will assist the consumer in choosing more desirable food items as it avoids a situation where a nutrient and/or health claim masks a possible undesirable nutrient. Nutrient profiles also aim to benefit the food manufacturers by encouraging food manufacturers to improve the nutritional quality of food items and together with this levelling the playing field for all food manufacturers (Wentzel-Viljoen *et al.,* 2012).

It can thus be concluded from the provided results, that the guideline on animal derived foods as provided in the FBDGs, is supported by the NPM.

3.5.2.2 FBDG: Eat dry beans, split peas, lentils and soya regularly

There is a substantial level of agreement (kappa statistic = 0.714) between the FBDG and the NPM classification of food items categorised in this guideline (n=14).

All food items mentioned or visually represented in the FBDGs booklet were classified as *eligible to carry a nutrient and/or health claim* with the exception of soya mince (beef and onion). This food item was disqualified due to the extremely high sodium content

The health benefits of legumes have been known for millennia (Venter & Van Eyssen, 2001). Soy protein can now also be regarded as a 'complete' protein, due to the protein digestibility-corrected amino acid score being equivalent to that of egg albumin (Young, 1991). Legumes are a cheap and healthy alternative to meat and in an age where nutritional experts are emphasising the need to decrease fat intake and to increase the intake of starchy foods and fibre, legumes fit naturally into the FBDGs (Venter & Van Eyssen, 2001).

The FBDGs of South Africa recommends that 'salt should be used sparingly', and in order to comply with this guideline processed food items with a high sodium content should be avoided. The sources of salt in the South African diet have not yet been adequately described; it is however clear from the limited amount of information provided that some processed food items and most likely grain products significantly contribute towards the daily salt intake of the population (Charlton & Jooste, 2001).

The NPM classification of a food item is based on the total composition of a food item as previously mentioned, therefore although the soya product is a healthy alternative to a meat product the sodium content of the soya mince disqualifies the product from making any nutrient and/or health claim. It should also be taken into account that the FBDGs have not adopted a quantitative approach to nutritional information. New legislation on the sodium content of food items is in the process of being implemented in South Africa, the draft Regulations Relating to the Reduction of Sodium in Certain Foodstuffs and Related Matters (No. R 533 of 2012) were published in the Government Gazette for comments on 11 July 2012. These regulations will aim to address the problem of 'healthy' food items with a high sodium content.

It can thus be concluded from the provided results that the NPM supports the guideline on legumes provided in the FBDGs with the exception of some of the processed soya products due to the high sodium content of these food items.

3.5.2.3 FBDG: Make starchy foods the basis of most meals

There is a substantial level of agreement between the FBDG and the NPM classification (kappa statistic = 0.734) of food items categorised in this guideline (n=17).

All starchy foods and food items visually illustrated and mentioned in the FBDGs were classified as *eligible to carry a nutrient and/or health claim* by the NPM. The refined, high fat and sugary starch products such as biscuits and sweet cereals, as mentioned in Annexure 6 of the draft food labelling regulations of 2007 (No R.642), were all classified as ***not*** *eligible to carry a nutrient and/or health claim.* The NPM thus supports the FBDG on starchy food items.

Arambepola and co-workers (2007) found the foods categorised by the BGH as 'bread, other cereals and potatoes' as the food group that had the lowest level of agreement with model WXYfm. It was reported that the developers of the BGH were aware of the fact that not all 'bread, other cereals and potatoes' are healthy food choices, but that they had no way of representing this in the pie chart (Gatenby *et al.,* 1995).

As indicated in table 7 only one food item from this food group was classified by the NPM as ***not*** *eligible to carry a nutrient and/or health claim* ("NO") of which the consumption was motivated by the FBDG ("YES"). The food item responsible for this disagreement in classification is the whole wheat crisp breads. The whole wheat crisp breads were disqualified by the NPM due to the high sodium content of the food item.

As mentioned previously new legislation on the sodium content of food items will address this discrepancy in food item classification of the NPM and FBDGs.

It can thus be concluded that the NPM supports the FBDG on the starchy food items.

3.5.2.4 FBDG: Eat plenty of vegetables and fruits daily

There is accumulating evidence that supports the claim that an increase in the daily consumption of vegetables and fruit can protect the public against certain types of cancers (Vorster *et al.,* 2001). Evidence also supports the protective role of vegetables and fruits

against cardiovascular diseases, with particular attention to flavonoid intake, as well as potassium, folate and fibre (Love & Sayed, 2001).

There was an almost perfect agreement between the NPM and FBDG classification of food items in the vegetable and fruit group. All the vegetables and fruits visually illustrated and mentioned in the FBDGs booklet was classified as *eligible to carry a nutrient and/or health claim* by the NPM. The only food items that were classified as ***not** eligible* were sugared fruit sticks and dried fruit rolls that were all included in Annexure 6 of the draft food labelling regulations of 2007 (No R.642 of 2007). The sugared fruit sticks and dried fruit rolls were disqualified from making any nutrient and/or health claim by the NPM, due to the high total sugar content of these food items. Food items such as fruit rolls and sugared fruit sticks are regularly considered by the consumers as a healthy alternative to sweets and biscuits, as many of these items carry numerous nutrient and/or health claims.

The FBDGs urges the public to "use foods and drinks containing sugar sparingly and not between meals". The disqualification of items such as sugared fruit sticks and dried fruit rolls by the NPM highlighted the importance of protecting the public from misleading messages and the significance of a NPM that classifies a food item based on its total nutrient composition.

It can thus be concluded that the NPM supports the FBDG on the regular consumption of vegetables and fruits and does not contradict any other nutritional information provided by the guidelines.

3.5.2.5 FBDG: Use foods and drinks containing sugar sparingly and not between meals

All food items visually illustrated and mentioned in the FBDGs as well as all the additional 'sugary' food items evaluated by the NPM were classified as ***not** eligible to carry a nutrient and/or health claim*. As indicated in Table 8, none of the evaluated food items received a "YES" classification from the NPM.

It can thus be concluded that there is an almost perfect agreement between the NPM and FBDGs classification of food items in this category and that no contradictions were present.

3.5.2.6 FBDG: Use salt sparingly

All the salt - containing food items visually illustrated and mentioned in the FBDGs and salt FBDG technical support paper (Charlton & Jooste, 2001) such as savoury spreads, biscuits, sauces, salty nuts and processed meats were all classified as ***not*** *eligible to carry a nutrient and/or health claim.*

The DOH, Directorate: Food Control published the new draft Regulations relating to the Reduction of Sodium in certain Foodstuffs and Related matters, No R. 533 for public comments in the Government Gazette on the 11th of July 2012. Food groups where the new Regulations relating to sodium reduction will have a significant effect with regards to the NPM classification, includes breads, breakfast cereals, savoury snacks, processed meats and raw-processed meat sausages.

It can thus be concluded that there is an almost perfect agreement between the NPM and FBDG classification of salt containing food items and that the NPM clearly supports the FBDG and do not contradict this guideline in any way.

3.5.2.7 FBDG: Eat fats sparingly

The guideline, 'eat fats sparingly', aims to lower the fat intake, especially intake of saturated fatty acids (SFAs), among those who follow a typical Western diet high in fat, and to control the fat intake in those who follow a diet low in fat (Wolmarans & Oosthuizen, 2001). The technical support paper for the FBDG on fat intake (Wolmarans & Oosthuizen, 2001), points out that the guideline motivates regular consumption of healthy plant - based fats such as nuts, canola oil, sunflower oil and olives. The guideline also motivates the public to avoid animal-derived fats, coconut and palm kernel oil, fried foods as well as products containing a high amount of 'hidden' fats such as full cream cheeses, convenience foods and snacks, biscuits and pies.

All the food items that were mentioned in the FBDGs booklet as fats and oils that are good choices were classified by the NPM as food items *eligible to carry a nutrient and/or health claim*. The only inconsistency in food item classification was with the roasted and salted nuts that were classified by the NPM as ***not*** *eligible to carry a nutrient and/or health claim*. These food items were disqualified from making any nutrient and/or health claim due to the high saturated fat and sodium content. The FBDGs booklet motivates the consumption of a range of nuts, peanuts and seeds but does not distinguish between 'salted', 'fried', 'roasted'

and ‘raw’ nuts. The raw peanuts were classified by the NPM as *eligible to carry a nutrient and/or health claim.*

Almost all the food items that were mentioned in the FBDGs booklet as fats that are not a good choice were classified as ***not*** *eligible to carry a nutrient an or health claim.* The only contradictions were with the potato chips/french fries (fried in sunflower oil), fish battered/crumbed (fried in sunflower oil) and homemade vetkoek (cake flour and water). The nutritional information of these food items was obtained from the FCTSA. It can thus be assumed that the home or commercial preparation method of these food items and the amount of added sodium may differ significantly from that of the items used in the FCTSA.

Therefore it can be concluded that there is a substantial level of agreement (kappa statistic = 0.638) between the FBDG and the NPM classification of food items (n=23) categorised in this guideline.

3.6 Conclusion

It can thus be concluded that the NPM has good content validity, the NPM classification of food items supports the FBDGs with the exception of a few processed food items and combined food items where the preparation method and the added sodium may differ significantly from that of the FCTSA. The comparison of ‘indicator’ food items with the FBDGs should however not be the only method of validity testing in the NPM as this is the first approach to validity testing and is only a weak form of validity testing. Testing for the convergent validity in a suitable NPM for South Africa is explained in Chapter 4.

CHAPTER 4

4. CONVERGENT VALIDITY

4.1 Introduction

The second approach to the validation of a NPM, as described in the 'Guiding principles and framework manual for the development or adaptation of nutrient profile models' (WHO, 2011), is the comparison of the ranking of food items by the NPM with the ranking of the same food items by nutrition experts. This method can be described as an assessment of convergent validity. Convergent validity can be defined as 'the extent to which the measurement correlates with an external criterion, of the phenomenon under study, at the same point in time' (Last, 2001).

4.2 Aim

The aim of the method of validation is:

- To compare the NPM classification of food items in a representative dataset of foods with the ranking of the same food items by nutrition experts.

4.3 Methodology

4.3.1 Compiling a food item master list

The method for testing for convergent validity was based on the work of Scaborough and co-workers (2007a; 2007b). The representative food item master list was generated by including the food items most frequently consumed by the participants of four different food consumption databases: Prospective Urban and Rural Epidemiological study (Wentzel-Viljoen, 2011), Cardiovascular Risk in Blacks South Africa (Levitt, 2010), Indian (MacIntyre, 2011) and The National Food Consumption Survey (Labadarios, 2000).

A master list of 128 food items (Addendum C) was generated. For this study Scaborough *et al.* (2007a; 2007b) compiled a master list of 120 food items. It was decided to use a master

list of 128 food items as to ensure that food items mentioned in the most contentious section (Annexure 6) of the draft food labelling regulations of 2007 would be included.

Nutritional information of the food items selected was collected from the Condensed Food Composition Tables for South Africa (FCTSA) (Wolmarans *et al.,* 2010) and the nutritional information panel of food products in and around Gauteng and the North West province. The average energy (kJ), saturated fatty acids (g), total added sugars (g), sodium (mg), protein (g) and fibre (g) content per 100g/mL portion of each of the food items were collected.

The number of portions per day, as indicated in the FBDG booklet for adults (25-60 years of age), was used to calculate the number of food items included in each food group. The FBDG booklet recommends a total 18 – 21 food portions daily. The suggested number of food items in each food group was calculated by dividing the recommended number of food items in the master list (n=128) by the suggested total daily food portions of the FBDG booklet (18–21). The calculated average (6.19) was then multiplied by the recommend number of portions in each food group. Table 10 provides a summary of the estimated number of food items in each of the food groups. A miscellaneous group was added to allow for the addition of food items not consumed frequently and for food items from the sugar group of which the suggested number of portions in the FBDG booklet is zero (n=0). The miscellaneous group was also used to include food items mentioned in Annexure 6 (Addendum A) of the draft food labelling regulations of 2007, as this was the section widely commented on by the scientific community and food industry and ultimately created the need to formulate a nutrient profiling system as a criterion for making nutrient and/or health claims.

Table 10: Number of food items per food group included in the master list

Food based dietary guideline	Food items	Suggested number of portions per day	Suggested number of food items included
Make starchy foods the basis of most meals	Grains and cereals	6 – 8	49
Eat plenty of vegetables and fruits every day	Vegetables and fruits	5	35
Eat dry beans, peas, lentils and soya often	Dried beans, peas, lentils and soya	1.5	11
Chicken, fish, milk or eggs could be eaten daily	Meat, chicken, fish and eggs	1.5	11
	Milk and dairy products	1	7
Eat fats sparingly	Fats and oils	3 – 4	21
Use foods and drinks containing sugar sparingly	Sugars	0	-

Miscellaneous	Various foods mentioned in Annexure 6		20

4.3.2 Unique randomised food item list

A software programme was developed which electronically generated unique randomised lists from the master list of 128 food items. Each uniquely randomised list included 40 food items randomly selected from the master list (n=128).

To assist with the categorisation of the food items, the average energy (kJ), saturated fatty acid (g), total added sugar (g), sodium (mg), protein (g) and fibre (g) content per 100g/ml serving of each of the food items was provided. This information was provided as these nutrients are incorporated into the NPM as well as some of these nutrients are considered to be of major public health concern (Arambepola *et al.,* 2007; Rayner *et al.,* 2005; Rayner *et al.,* 2004).

4.3.3 Data collection and analysis

All full members of the Association of Dietetics in South Africa (ADSA), meaning that the members were all registered as dietitians with the Professional Board for Dietetics and Nutrition of the Health Professions Council of South Africa (HPCSA) were considered as the nutrition experts in South Africa and thus the bench mark for convergent validity assessment. The e-mail address of all full members of ADSA (n=1105) was collected from the president of ADSA and a total of 1105 uniquely randomised food item lists were generated. The individually randomised food item lists were then emailed to all full members (n=1105) of ADSA.

Each respondent was asked to rank the randomly selected food items (n=40) in their unique randomised list according to their knowledge of food and the nutritional information provided on a 6-point Likert scale from “less healthy” (1) to “more healthy” (6). A “less healthy” food item would be considered as a food item which should be eaten infrequently and/or in small amounts and a “more healthy” food item would be a food item which should be eaten frequently and/or in large amounts by a person aiming to meet public health nutrition recommendations. Respondents were asked to rate food items from all food groups with each other, rather than food items from similar food groups with each other. The

respondents sent the spread sheets back to the researchers and the results were read into an Excel database.

Each individual food item was read into the excel database and received a unique number, the amount of times that the food was randomly selected by the software program was determined and included into the database. The number of times that a food item received a specific ranking (1–6) by the nutrition experts was entered into the database and mean ranking awarded by nutritional experts to each food item was calculated (Addendum C).

The food items (n=128) of the master list were all ranked form “more healthy” to “less healthy” according to their mean ranking awarded by the nutrition experts. The NPM classification of each of the food items in the master list was determined. A food item that was classified as *eligible to carry a nutrient and/or health claim* by the NPM was classified as a “YES” item and a food item classified as ***not*** *eligible to carry a nutrient and/or health claim* by the NPM was classified as a “NO” food item. The classification of food items by the NPM was then compared to the ranking of the same food items by the nutrition experts.

Statistical analysis was done using the computer software package SPSS (SPSS Inc., 2009). Statistical significance was regarded as a p-value ≤ 0.05. Pearson’s rank order correlation coefficient was determined between the NPM classification and nutrition expert mean ranking.

4.4 Results

A total number of 292 responses were received, giving a total response rate of 26.4%. No responses were excluded from the analysis. Figure 3 indicates the comparison of the mean ranking awarded by the nutrition experts to the 128 food items with the classification awarded by the NPM.

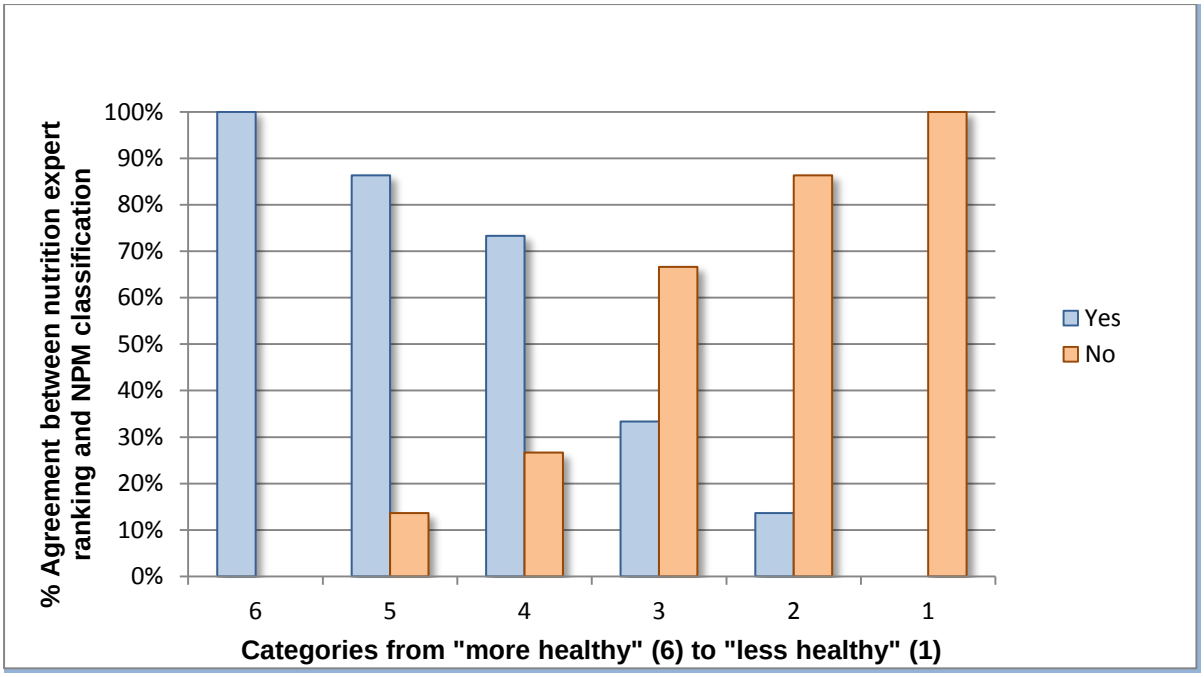

Figure 3: Comparing the ranking of food items by nutrition experts to the classification of food items by the NPM

It is indicated in Figure 3 that 100% of the food items ranked by the nutrition experts as the "more healthy" food choice was classified by the NPM as *eligible to carry a nutrient and/or health claim.* Figure 3 also indicates that a 100% of the food items ranked by the nutrition experts as the "less healthy" food choice were classified by the NPM as a food item ***not*** *eligible to carry a nutrient and/or health claim.*

Table 11: The top 15 and bottom 15 ranked food items according to the nutrition experts

Food name	Ranking	NPM classification	Mean ranking by nutrition experts	Number of times randomly included in a list
Apple, raw	1	YES	5.9	81
Pear, raw	2	YES	5.8	91
Peach, raw	3	YES	5.8	90
Orange, raw	4	YES	5.8	91
Mango, raw	5	YES	5.7	95
Banana, raw	6	YES	5.7	72
Sugar beans, cooked	7	YES	5.6	93
Oats porridge	8	YES	5.6	84
Spinach, boiled	9	YES	5.5	90
Skim milk, fresh	10	YES	5.5	95
Pumpkin, cooked	11	YES	5.5	86
Mixed vegetables, boiled (carrot, corn, peas, green beans etc.)	12	YES	5.5	86
Litchi, raw	13	YES	5.5	74
Grapes, raw	14	YES	5.4	88
Gem squash, boiled	15	YES	5.4	96
Viennas, processed, fresh	114	NO	1.8	79
Onion soup powder	115	NO	1.8	85
Marshmallows	116	NO	1.8	79
Vienna plain, canned	117	NO	1.6	86
Plain homemade cookies (hard margarine)	118	NO	1.6	74
Biscuits, plain, commercial	119	NO	1.6	105
Polony, plain	120	NO	1.5	80
Chocolate cake, plain	121	NO	1.5	96
Potato crisps	122	NO	1.4	86
Hard margarine	123	NO	1.4	104
Doughnut with jam	124	NO	1.4	96
Non- dairy creamer, powder	125	NO	1.3	71
Niknaks, fritos, etc (maize based)	126	NO	1.3	89
Choc-kit biscuits	127	NO	1.3	91
Carbonated cold drink	128	NO	1.3	72

The classification of the food items by the NPM correlated very well with the ranking of food items by the nutrition experts (Pearson r = 0.853; p = 0.0001)

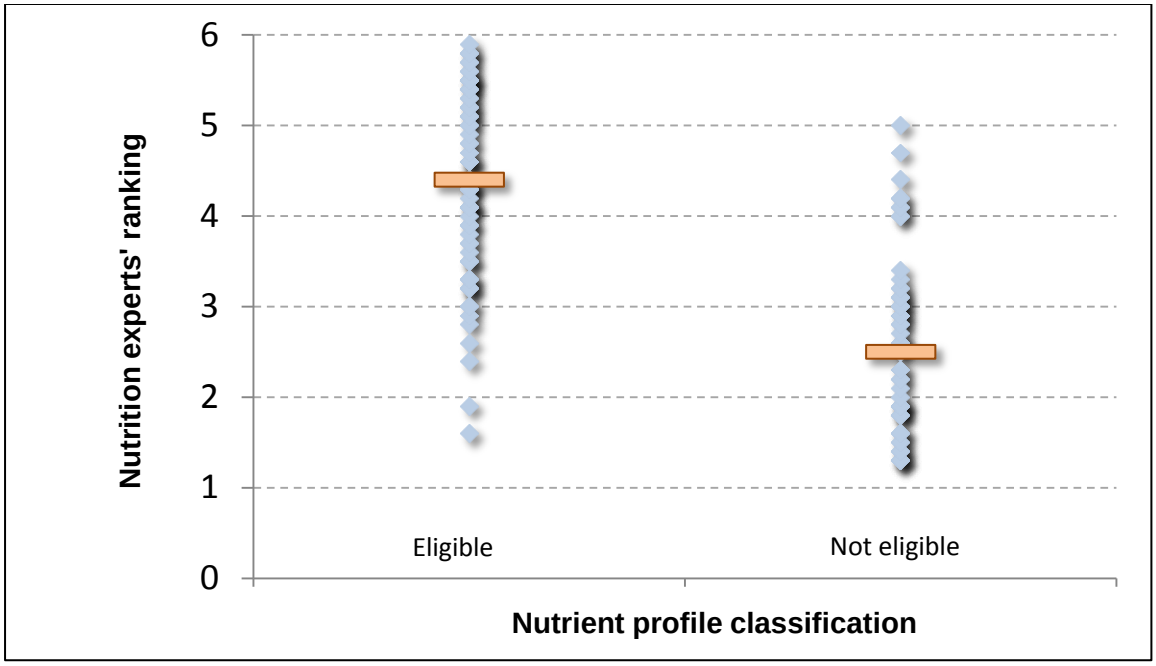

Figure 4: Nutrition experts' ranking of food items compared to the NPM classification

The median score provided to food items classified by the NPM as *eligible to carry a nutrient and/or health claim* was 4.4. The median score provided to food items classified by the NPM as ***not*** *eligible to carry a nutrient and/or health claim* was 2.5.

Table 12: Food items ranked by nutrition experts as the "less healthy" food choice and classified by the NPM as eligible

Food item name	NPM classification	Mean ranking
Vetkoek (Plain)	YES	1.6
Mayonnaise	YES	1.9
White bread / rolls	YES	2.4
Health bar (pear & current)	YES	2.6
Fruit cocktail, canned in syrup	YES	2.9

The food items indicated in table 13 are the few items that were ranked by the nutrition experts as the "more healthy" food item and were classified by the NPM as *not eligible.* The high amount of sodium and sugar in these items was the disqualifying factor.

Table 13: Food items ranked by nutrition experts as a "more healthy" food choice and classified by the NPM as not eligible

Food item name	NPM classification	Mean ranking
Soya mince	NO	4
Dry fruit roll (no sugar added)	NO	4.1
Mixed dried fruit	NO	4.1
Tomato pasta sauce (low fat & low salt)	NO	4.2
Whole wheat crisp bread (e.g. Provita)	NO	4.4
Low fat milk, powder (vitamins added)	NO	4.7
Dried bean soup (with beef and vegetables)	NO	5

4.5 Discussion

The aim of this chapter was to compare the NPM classification of food items with the ranking of the same food items by nutrition experts.

The response rate of nutrition experts (26.4%) to the questionnaire can be considered as a good response rate as Scarborough and colleagues (2007b) conducted similar research and had a response rate of 24%. The highest average ranking (indicating the "more healthy" food items) was attained by foods in the vegetable and fruit group, and the lowest average ranking (indicating the "less healthy" food items) was in the fats and sugary foods group (table 11). The average ranking of food items by nutrition experts is thus in accordance with the FBDGs of South Africa.

The healthiest food item according to the views of nutritional experts as indicated in table 11 was a raw apple with a mean ranking of 5.9. The least healthy food items, all with a mean ranking of 1.3 according to the views of nutrition experts, was carbonated cold drinks, sweet biscuits, maize based savoury snacks and non-dairy coffee creamers (table 11). These food items were all classified as ***not*** *eligible to carry a nutrient and/or health claim* by the NPM. Scarborough *et al.* (2007a; 2007b) found similar results, the vegetable and fruit group received the highest average score (5.16) and the fats and sugar group received the lowest average score (1.93). The healthiest food item according to the nutrition experts in the study conducted by Scarborough and researchers (2007b) was a 'raw green pepper' with an average score of 5.91 and the least healthy food item was 'clotted cream' with an average score of 1.21.

The mean ranking of food items generated by the survey of nutrition experts as indicated in figure 4 correlates well with the NPM classification of food items (Pearson r = 0.853; p = 0.0001). The ranking of food items by nutrition experts also appears to be in agreement with the general healthy eating advice (FBDGs) and previous research.

The NPM classification and corresponding nutrition expert ranking of some of the food items is however surprising. For instance tomato pasta sauce (low fat & low salt), whole wheat crisp breads and low fat milk powder (vitamins added) received a mean ranking by nutrition experts of 4.2, 4.4 and 4.7 respectively and were all thus considered as a "more healthy" food item. All of these food items were however disqualified by the NPM from making any nutrient and/or health claim. The tomato pasta sauce had high total sugar content and the whole wheat crisp breads and low fat milk powder had high sodium content. White bread and fruit cocktail in syrup received a mean ranking of 2.4 and 2.9 respectively and were all classified as '*eligible'* by the NPM. Scarborough and researches (2007b) found similar results and argued that this might imply that the respondents were using descriptive prompts, such as 'whole wheat' and 'low fat' to guide their judgements over and above the nutritional data provided.

There was a slight disagreement between the NPM classification of food items and the mean ranking of food items by nutrition experts. Table 12 indicates the few food items ranked as the "less healthy" options by the nutrition experts that were classified as '*eligible'* food items by the NPM. All of these food items had relatively high total energy (kJ) contents but the saturated fat (g) and sodium contents (mg) were fairly low. It should however be taken into account as mentioned in chapter 3 (content validity) that the preparation method of "vetkoek" as well as the type of oil and the amount of added sodium used may differ greatly from that of the product used in the FCTSA. The total energy content of the health bar (pear and current) was high (1303kJ/100g) but the saturated fat and the sodium content was low; the health bar also had a relatively high fibre content. The total energy content of the fruit cocktail, canned in syrup (322kJ/100g) was relatively low, the sodium and added sugar content was also low. The total energy content (kJ) of both the soya mince and dried fruit roll (no sugar added) was high. The soya mince was nonetheless still classified by the NPM as *not eligible to carry a nutrient and or health claim ,*even with the low saturated fat and high fibre content, due to the extremely high sodium content (3206mg/100g). The dried fruit roll (no sugar added) had high fibre content, but still had a total sugar content of 39.8g/100g; which is considered as tremendously high sugar content and is the main contributing factor to the classification as ***not*** *eligible to carry a nutrient and/or health claim* by the NPM.

These results support Scarborough and researches' (2007a) finding that respondents were using descriptive prompts to guide their judgements over and above the nutritional data that was provided. Other factors contributing to the variance in the classification of food items could have been the nutrition experts knowledge of the health effects of foods, which depends on more than nutrient composition; for example the bioavailability of nutrients, the effects of consuming foods in combination with others, the freshness of foods and the degree to which a food item has been processed (Paquette, 2005). The difficulty of using all the nutritional information provided when categorising food items may also contribute towards the variance in food item classification.

4.6 Conclusion

It can thus be concluded from the provided results that there is a good correlation between the classification of food items by the NPM and the views of nutrition experts in South Africa. The use of the standard ranking of food items derived from a survey of views of nutrition experts should however not be the only method of validity testing in the NPM, due to the fact that nutrition experts might display inconsistent logic in the way that they categorise food items.

CHAPTER 5

5. COLLECTIVE CONCLUSIONS AND RECOMMENDATIONS

This study set out to validate a suitable NPM for South Africa. In order to achieve the overall aim of this study**,** content and convergent validity of the NPM was tested according to the approaches of validation described in the 'Guiding principles and framework manual for the development or adaptation of nutrient profile models' (WHO, 2011). This chapter will summarise the findings and conclusions drawn from these two approaches to validation.

5.1 Content validity

The NPM showed good content validity, as the NPM classification of food items had a substantial agreement with the FBDGs classification of food items. The NPM classification of food items supported the FBDGs with the exception of a few processed food items and combined food items where the nutritional information was sourced from the FCTSA

Standard recipes were used to calculate the nutrient composition of the combined food items (e.g. vetkoek) in the FCTSA. Since this is not an analysis of the food item per se, it could be the reason why the saturated fat and sodium content of these food items is low, thus clarifying the discrepancy in the NPM and FBDGs classification of food items. The nutritional information provided by the FCTSA and the nutritional information panel of food items differed in terms of the sodium content in some of the processed food items (e.g. bran flakes). A total of 28.5% of the nutrient composition of food items in the FCTSA was sourced from the United States Department of Agriculture, which might explain the differences in sodium contents of some food items. This might have contributed to the disqualification of certain food items where the nutritional composition of the food item could not be sourced from the nutrition information panel of a product.

The new draft Regulations relating to the Reduction of Sodium in certain Foodstuffs and Related matters, No R. 533 of 2012 will have a significant effect on the NPM classification of some of the processed food items. However food items not included into the draft Regulations and of which regular consumption is still motivated by the FBDGs, such as soya mince, will have to reduce the sodium content voluntary in order to be eligible for making any nutrient and/or health claim.

The comparison of the NPM classification of 'indicator' food items with the FBDGs showed good content validity, there were no obvious anomalies which might affect the credibility of the NPM. Content validity testing should however not be the only method of validity testing in the NPM, as this is only an individual validity assessment.

5.2 Convergent validity

There was a good correlation between the classification of food items by the NPM and the views of nutrition experts in South Africa. The ranking of food items by nutrition experts related well to the classification of food items by the NPM with the exclusion of some processed foods and the "vetkoek". The high sodium content of some of the processed food items contributed again to the disqualification of food item by the NPM. The nutritional composition of "vetkoek" was sourced from the FCTSA which could be the reason why the saturated fat and sodium content of this food item is low and might have contributed to the difference in food item classification by the NPM and the ranking of nutrition experts.

The ranking of some of the food items by the nutrition experts was surprising. It seemed as if the nutrition experts were using descriptive prompts to guide their judgements of the 'healthiness' of food items, over and above the nutritional information provided to them.

The use of the standard ranking of food items derived from a survey of views of nutrition experts does agree with the NPM classification of food items but should however not be the only method of validity testing in the NPM, due to the fact that nutrition experts are not entirely logical and consistent in the way that they categorise food items.

5.3 Limitations of this study

The validation process described in this mini-dissertation was only concerned with the credibility of food item classification produced by the NPM. Only the first two approaches (content and convergent validity) of validation as described in the 'Guiding principles and framework manual for the development or adaptation of nutrient profile models' (WHO, 2011) was used. This was only the first step in the validation and testing process of the NPM.

5.4 Recommendations

- In 2011 a national working group was established to revise the FBDGs in order to increase its relevance to the rapidly urbanising South African population. It is therefore recommended that the NPM classification of food items also be compared to the proposed revised FBDGs.
- The validation approaches aimed at reinforcing the concept of nutrient profiling as outlined by the draft recommendation of the WHO (WHO, 2011), was completed by fellow researchers at the North West University. It is strongly recommended that these validation approaches be reported on, in order to strengthen the concept of nutrient profiling.
- Registered dietitians were considered as the nutrition experts in South Africa and play a critical role in nutritional education in the general public, it is therefore recommended that dietitians be educated about the concept of nutrient profiling and the interpretation of total nutritional composition of a food items.
- The proposed revised FBDGs (2012) motivate regular consumption of soya, soya mince was however disqualified from making any nutrient and/or health claims by the NPM due to the extremely high sodium content. Soya products are healthy and cheap alternatives to meat and it is therefore recommended that the draft Regulations on sodium reduction in foodstuffs include soya products.

5.5 Main findings and conclusion

It is of great importance to bear in mind that nutrient profiling cannot solve all the problems with relation to diet and health, as the nutrient composition of food items is not the only determinant of health and due to the fact that the NPM is solely intended to assess the eligibility of a food item to carry a nutrient and/or health claim. Nutrient profiling of food items will however definitely address stakeholders' demand for a scientific and evidence-based approach to determining the eligibility of a food item to carry a nutrient and/or health claim and will benefit both the consumers and food manufactures.

It can consequently be concluded that the NPM has good content and convergent validity and that the NPM produces reliable food item classification which corresponds with the FBDGs and is supported by the views of nutrition experts in South Africa.

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ADDENDUM A

Annexure 6 of the Regulations Relating to the Labelling and Advertising of Foodstuffs No R. 642, 20 July 2007

DEPARTMENT OF HEALTH

No. R 642 20 July 2007

FOODSTUFFS, COSMETICS AND DISINFECTANTS ACT, 1972 (ACT 54 OF 1972)

REGULATIONS RELATING TO THE LABELLING AND ADVERTISING OF FOODSTUFFS

ANNEXURE 6

FOODSTUFFS NOT CONSIDERED ESSENTIAL FOR A HEALTHY DIET AND FOR WHICH *NO* NUTRIENT CONTENT, GI, CERTAIN COMPARATIVE, HEALTH, SLIMMING OR ANY OTHER CLAIM WITH A HEALTH OR NUTRITIONAL MESSAGE WILL BE PERMITTED

Beverages

• Carbonated or un-carbonated soft drinks intended to be consumed cold, which contain sweetener(s) and additives in any form (e.g. powders, concentrates or ready-to-drink type etc.)

• Fruit nectars

• Soft drinks bearing the word “energy” or “sport” or “power” in any way on the label, with or without caffeine

• Iced teas in any form (e.g. powders, concentrates or ready-to-drink type etc.), which contain sweetener(s) and additives Powders to prepare hot or cold beverages for which any one or more of the following criteria apply:

- Contain more than 10 g sugar per single serving
- Contain fully or partially hydrogenated fat
- Contain any non-nutritive sweetener(s)
- Contain any artificial colourant(s)

Sweet biscuits and flour confectionary

• All sweet, dry biscuits, unless–

- the biscuit has been specifically developed and formulated for the purpose of preventing or correcting a demonstrated nutrient deficiency as recognised by the Department;
- the impact of the special biscuit on the target population/group has been scientifically evaluated by at least one human intervention trial;
- written proof of the outcome has been published in an acceptable medical or nutrition journal or reported at a national nutrition congress; and

- a request for approval accompanied by the above-mentioned documentation has been granted by the Directorate: Food Control prior to retail market appearance
    - All cakes
    - Other sweet flour confectionary such as muffins, doughnuts, sweet pastries and
    - others, unless the product is high in fiber and has a low Glycaemic Index value

• Sweet tarts

Candies and chocolate confectionary

- All chocolate confectionary
- All sugar confectionary, including toffees
- Chewing gum

Fast foods

Any fast food meal of which any one or more of the following criteria apply-

- which contains any trans fats;
- of which the main carbohydrate component of the meal (e.g., bread bun of a hamburger) has a high Glycaemic Index value;
- has a fiber content of less than 3 g per 100 g end product;
- has a salt content of 1,25 g salt per 100 g end product or more; and
- has a saturated fat content of more than 5 g per 100 g end product
- which has been prepared/cooked in an vegetable oil that has been subjected to any of the following processes: any form of heat treatment, degumming, refining, bleaching and deodorizing

Savoury foodstuffs

- Ready-to-eat savoury snacks such as potato crisps, extruded or expanded maize snacks etc.
- Ready-to-eat dips or dip powders intended to be reconstituted with a fat content of more than 3 g per 100g

Desserts

- Baked type desserts, with a fat content of more than 10 g per 100 g and a sugar content of more than 15 g per 100 g
- Chilled, ready-to-eat desserts
- Ice cream, frozen yoghurt, frozen desserts, frozen treats, sorbets, edible ices and any other similar product containing more than 20 g per 100 g carbohydrates and/or more than 3 g total fat per 100 g

- Instant dessert powders
- Jellies

Other

• Any vegetable oil that has been subjected to any of the following processes: any heat treatment, degumming, refining, bleaching and deodorizing, and packed in see through plastic containers

• Commercially prepared meat pies and sausage rolls and pies wit a savoury filling

• Dry soup powders

• Flavoured fat spreads or margarine

• Speads, toppings, glazes or filling sold as such for cakes, desserts and tarts

• “Health” bars, breakfast bars, seed bars or energy bars with a sugar content more than 10 g per bar, a saturated fat content of more than 1 g per 100 g or any trans fat

ADDENDUM B
Food item classification by the NPM and FBDGs

Food Based Dietary Guideline	Food Product	NPM classification	FBDG classification
Chicken, milk, meat or fish could be eaten daily	Milk full cream, fresh	YES	YES
	Milk Low fat, long life	YES	YES
	Milk powder, full cream	NO	YES
	Milk powder, Low fat	NO	YES
	Maas	YES	YES
	Yogurt, flavoured, Low fat	YES	YES
	Cheese, Gouda	NO	YES
	Polony, Beef & Pork	NO	NO
	Viennas, Beef & Pork	NO	NO
	Eggs	YES	YES
	Chicken, boiled, meat & Skin	YES	YES
	Chicken, batterd, fried	NO	NO
	Beef, chuck, cooked	NO	YES
	Beef, mince, topside, lean	YES	YES
	Cold meat, offal, cooked, brawn/ tongue	NO	NO
	Sardines, tinned in brine	NO	YES
	Sardines, tinned in vegetable oil	YES	YES
	Tuna, tinned in water	YES	YES
	Pilchards, tinned in tomato sauce	YES	YES
	Fish, batterd/Crumbed, fried in sunflower oil	YES	YES
	Fish, frozen, fingers	NO	YES
	Liver, Beef, fried	YES	YES
	Chicken, feet, cooked	YES	YES
	Chicken, giblets, cooked	YES	YES
	Peanutbutter	YES	YES
	YES total	**15**	**21**
	NO total	**10**	**4**
Eat dry beans, split peas, lentils and soya regularly	Baked beans, canned in tomato sauce	YES	YES
	Beans, butter, canned in brine	YES	YES
	Chick peas, canned	YES	YES
	Lentils, canned in brine	YES	YES
	Lentils, soup mix, four in one, raw	YES	YES
	Lentils, whole	YES	YES

	Soya, mince, beef & onion	NO	YES
	Soya, sausage	NO	YES
	Split peas	YES	YES
	Three bean salad, commercial	YES	YES
	Peanutbutter	YES	YES
	Peanuts, raw	YES	YES
	Peanuts, roasted	NO	YES
	Nuts, mixed,(almond, cashew, peanuts, hazel, brazil)	NO	YES
	YES total	**10**	**14**
	NO total	**4**	**0**
Make starchy foods the basis of most meals	Bread, Brown	YES	YES
	Bread, White	YES	YES
	Bread, Whole wheat	YES	YES
	Cereal, Bran Flakes, All Bran	YES	YES
	Cereal, Coco Pops	NO	NO
	Cereal, Corn Flakes	NO	NO
	Crisp Bread, Cracker Bread, Wheat	YES	YES
	Crisp Bread, Whole Wheat, Provita	NO	YES
	Crisp Bread, Refined, High fat, Bacon Kips	NO	NO
	Mealie, Sweet Corn	YES	YES
	Pasta Macaroni	YES	YES
	Porridge, Mabella, Sorghum	YES	YES
	Porridge, Maizemeal	YES	YES
	Porridge, Oats	YES	YES
	Potato, Boiled	YES	YES
	Rice, cooked	YES	YES
	Sweet Potato, White,boiled	YES	YES
	YES total	**13**	**14**
	NO total	**4**	**3**
Eat plenty of vegetables and fruits daily	Apple, Granny Smith	YES	YES
	Banna, fresh	YES	YES
	Beetroot, salad, commercial	YES	YES
	Carrot, canned	YES	YES
	Carrot, fresh	YES	YES
	Dried fruit, Apple rings	YES	YES
	Dried fruit Roll, Mixed Berries	NO	YES
	Fruit sticks, Sugared	NO	YES

	Green Beans, Frozen	YES	YES
	Mixed Vegetables, Canned	YES	YES
	Mixed Vegetables, frozen	YES	YES
	Peach, canned in light syrup	YES	YES
	Peach, fresh	YES	YES
	Pear, canned, in syrup	YES	YES
	Pear, canned, in juice	YES	YES
	Pear, fresh	YES	YES
	Peas, canned	YES	YES
	Pumpkin, raw	YES	YES
	Spinach, raw	YES	YES
	Tomato, raw	YES	YES
	Tomato,whole, peeled, canned	YES	YES
	YES total	**19**	**21**
	NO total	**2**	**0**
Use food and drinks containing sugar sparingly and not between meals	Biscuits, commercial, Eat sum more	NO	NO
	Biscuits, high fibre, Beta Snack	NO	NO
	Cold Drink, Carbonated, average eg. Coke, Cream Soda	NO	NO
	Cold Drink, Squash	NO	NO
	Ice Cream, Sorbet	NO	NO
	Ice Cream, vanilla, regular	NO	NO
	Juice, Nectar, Halls/ Ceres	NO	NO
	Malted powder drink, Milo/ Horlicks	NO	NO
	Spread, Marmalade/ Jam	NO	NO
	Sugar, White, Granulated	NO	NO
	Sweets, Chocolate, Plain	NO	NO
	Sweets, Fudge caramel, toffee	NO	NO
	Sweets, gelatine, Wine Gums	NO	NO
	Sweets, Marshmallows	NO	NO
	Syrup, Golden	NO	NO
	YES total	**0**	**0**
	NO total	**15**	**15**
Use salt sparingly	Bovril	NO	NO
	Cheese, Gouda	NO	NO
	Cold meat, offal, cooked, brawn/ tongue	NO	NO
	Crisps, Potato	NO	NO
	Fray Bentos	NO	NO

	Marmite	NO	NO
	Polony, Beef & Pork	NO	NO
	Salt, table, iodated	NO	NO
	Sauce, Barbeque, commercial	NO	NO
	Sauce, gravy, Brown	NO	NO
	Sauce, Soy	NO	NO
	Sauce, Tomato	NO	NO
	Sauce, Worcestershire	NO	NO
	Savory biscuits, salted, Salti Crax	NO	NO
	Soup powder, onion	NO	NO
	Viennas, Beef & Pork	NO	NO
	YES total	**0**	**0**
	NO total	**16**	**16**
Eat fats sparingly	Biscuits, commercial, Eat sum more	NO	NO
	Biscuits, high fibre, Beta Snack	NO	NO
	Butro, spread	NO	NO
	Butter, spread	NO	NO
	Cheese, Gouda	NO	NO
	Cheese, cream, low fat	NO	NO
	Chicken, batterd, fried	NO	NO
	Chips, fries, potatoes	YES	NO
	Creamer, Non-dairy, Coffee & Tea	NO	NO
	Crisps, Maize eg. NikNaks, Cheese Puffs	NO	NO
	Crisp, Potato	NO	NO
	Doughnut, Jam	NO	NO
	Fish, batterd/Crumbed, fried in sunflower oil	YES	NO
	Margarine, Hard, Brick	NO	NO
	Margarine, Soft, Tub, Light	YES	YES
	Oil, Canola	YES	YES
	Oil, Sunflower	YES	YES
	Oil, Olive	YES	YES
	Olives, canned, pitted, drained	YES	YES
	Peanut butter	YES	YES
	Peanuts, roasted	NO	YES
	Peatnuts, raw	YES	YES
	Vetkoek	YES	NO
	YES total	**10**	**8**
	NO total	**13**	**15**

Addendum C

Standard ranking of food items by nutrition experts and NPM classification of the food items

Food item	Standard ranking	NPM classification	Mean ranking by nutrition experts
Apple, raw	1	YES	5.9
Orange, raw	2	YES	5.8
Peach, raw	3	YES	5.8
Pear, raw	4	YES	5.8
Banana, raw	5	YES	5.7
Mango, raw	6	YES	5.7
Oats porridge	7	YES	5.6
Sugar beans, cooked	8	YES	5.6
Litchi, raw	9	YES	5.5
Mixed vegetables, boiled (carrot, corn, peas, green beans etc.)	10	YES	5.5
Pumpkin, cooked	11	YES	5.5
Skim milk, fresh	12	YES	5.5
Spinach, boiled	13	YES	5.5
Broccoli Florets, frozen	14	YES	5.4
Gem squash, boiled	15	YES	5.4
Grapes, raw	16	YES	5.4
Baby Peas, frozen	17	YES	5.3
French salad (lettuce, cucumber, tomato, no dressing)	18	YES	5.3
Cabbage, cooked	19	YES	5.2
Potato, boiled (with skin)	20	YES	5.2
Sweet potato, boiled without skin	21	YES	5.2
Pilchards in tomato sauce, canned	22	YES	5.1
Samp and beans	23	YES	5.1
Chick peas, canned	24	YES	5.1
Butter beans, canned	25	YES	5
Low fat / 2% milk, fresh	26	YES	5
Dried bean soup (with beef and vegetables)	27	NO	5
All Bran flakes	28	YES	4.9
Pear, dried stwed without sugar	29	YES	4.8
Tomato, whole, canned	30	YES	4.8
Baked beans in tomato sauce, canned	31	YES	4.7
Low fat milk, powder (vitamins added)	32	NO	4.7
Low fat fruit yoghurt, sweetened	33	YES	4.6
Olive oil	34	YES	4.6
Pro-Nutro (original) (vitamin and mineral	35	YES	4.6

enriched)			
Raisons	36	YES	4.6
Muesli (original, high fibre)	37	YES	4.4
Olive	38	YES	4.4
Provita	39	YES	4.4
Canola oil	40	YES	4.3
Lean beef mince, cooked	41	YES	4.3
Maas/ sour milk	42	YES	4.3
Mabella porridge	43	YES	4.3
Tomato and onion, canned	44	YES	4.2
Peanutbutter	45	NO	4.2
Tomata pasta sauce (low fat & low salt)	46	NO	4.2
Brown bread	47	YES	4.1
Chicken liver, cooked	48	YES	4.1
Mahewu / magou	49	YES	4.1
Maize meal porridge, soft (fortified)	50	YES	4.1
Weet-bix	51	YES	4.1
Dry fruit roll (no sugar added)	52	NO	4.1
Mixed dried fruit	53	NO	4.1
Fresh fruit juice	54	YES	4
Low fat yoghurt drink	55	NO	4
Soya mince	56	NO	4
Chicken, boiled (meat and skin)	57	YES	3.9
Fruit bar (pear & current)	58	YES	3.9
Fruit cocktail, canned in juice	59	YES	3.9
Rice, white	60	YES	3.8
Mixed vegetables, canned	61	YES	3.7
White macaroni/spaghetti, cooked	62	YES	3.7
Chicken giblets, cooked	63	YES	3.6
Full fat milk, fresh	64	YES	3.5
Low-fat soft margarine	65	YES	3.5
Muesli (jungle energy)	66	YES	3.5
Bran muffin	67	NO	3.4
Nutri rusks, commercial	68	YES	3.3
Peanuts, roasted, salted	69	YES	3.3
Sunflower oil	70	YES	3.3
Fruit Sticks	71	NO	3.3
Coleslaw, commercial	72	YES	3.2
Gouda cheese (reduced fat)	73	YES	3.2
Tomato sauce	74	YES	3.2
Appletizer	75	NO	3.2
Mutton, roasted (leg)	76	NO	3.2
Low calorie jelly powder	77	NO	3.1
Mutton, braised (shoulder)	78	NO	3.1
White fish, battered/crumed and fried in	79	NO	3.1

sunflower oil			
Artificially sweetened squash cold drink	80	YES	3
Egg, fried in sunflower oil	81	YES	3
Milo / Horlicks, powder	82	NO	3
Milo prepared, commercial	83	NO	3
Water, flavoured (vitamin enriched)	84	NO	3
Fruit cocktail, canned in syrup	85	YES	2.9
Cornflakes (vitamin enriched)	86	NO	2.9
Cream cheese, low fat	87	NO	2.9
Dairy fruit mix, e.g. Tropica	88	NO	2.9
Coffee	89	YES	2.8
Cheddar cheese	90	NO	2.8
Pretzels	91	NO	2.8
Cheerios (original) (vitamin and mineral enriched)	92	NO	2.7
Health bar (e.g. Snacker)	93	YES	2.6
Fruit chutney	94	NO	2.6
Ice Cream (vitamin enriched)	95	NO	2.6
Marmite	96	NO	2.6
Slim Slab	97	NO	2.6
Bovril	98	NO	2.5
Mango atchar	99	NO	2.5
White bread / rolls	100	YES	2.4
Coco pops	101	NO	2.3
Gelatine type sweets (e.g. wine gums)	102	NO	2.3
Ice cream, plain	103	NO	2.2
Scone, plain	104	NO	2.2
Worceshire sauce	105	NO	2.1
Cream cheese full fat	106	NO	2
Mayonnaise	107	YES	1.9
Boerewors, cooked	108	NO	1.9
Buttermilk rusks, commercial	109	NO	1.9
Cheese spread, full fat	110	NO	1.9
Chicken, batter dipped and fried	111	NO	1.9
Jelly babies	112	NO	1.9
Marshmallows	113	NO	1.8
Onion soup powder	114	NO	1.8
Viennas, processed, fresh	115	NO	1.8
Vetkoek	116	YES	1.6
Biscuits, plain, commerial	117	NO	1.6
Plain homemade cookies (hard margarine)	118	NO	1.6
Vienna plain, canned	119	NO	1.6
Chocolate cake, plain	120	NO	1.5
Polony, plain	121	NO	1.5
Doughnut with jam	122	NO	1.4

Hard margarine	123	NO	1.4
Potato crisps	124	NO	1.4
Carbonated cold drink	125	NO	1.3
Choc-kit biscuits	126	NO	1.3
Niknaks, fritos, etc (maize based)	127	NO	1.3
Non-dairy creamer, powder	128	NO	1.3