

The intake and quality of breakfast consumption among adolescents attending public secondary schools in Potchefstroom

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Abstract

Regular breakfast consumption among adolescents has been linked to decreased risk of obesity and chronic diseases, improved cognition and improved nutrient intake in adolescents. Despite this, research has indicated that adolescent breakfast consumption is declining globally. Adolescents are at particularly high-risk for health compromising behaviours such as increased fast food consumption, increased sedentary levels and frequent breakfast skipping. Research shows that lifestyle and behaviour habits which are entrenched during adolescence are likely to remain throughout adulthood.

The reported prevalence of breakfast skipping among different adolescent population groups in South Africa ranges from 13 to 36%. However, little is known about breakfast behaviour among adolescents in the South African context.

Studying breakfast behaviour and the mechanism by which breakfast influences positive health outcomes creates an understanding of the magnitude of the problem to be addressed and guides effective recommendations for public health guidelines.

The aim of the present study was to determine the proportion and quality of breakfast intake among adolescents attending public secondary schools in Potchefstroom and its surrounding areas in the Northwest Province, and to determine the effect of breakfast intake and quality on overall diet quality and other lifestyle behaviours.

A cross sectional quantitative study design was used. Adolescents in grades nine to eleven (n = 254) were randomly selected from seven public secondary schools across quintiles in Potchefstroom and its surrounding areas in the Northwest Province of South Africa. A basic self-administered demographic questionnaire was used. A single 24-hour recall using the four-stage multiple pass method was conducted to obtain information on breakfast and dietary intake for the day. A self-administered questionnaire was used to select the type of breakfast usually consumed by the adolescents. Height and weight were measured by a level one anthropometrist. Dietary data was analysed using the Medical Research Council Food Composition Tables. Breakfast quality was measured through the allocation of a breakfast quality score and the Diet Quality Index Revised (DQI-R) was used to assess the quality of the

overall diet. Associations between breakfast intake and categorical characteristics were assessed by either the Chi-squared Test or Fisher's Exact Test. Spearman correlations were used to assess the associations between breakfast quality score and continuous variables. The threshold for statistical significance was set at 0.05. The Goldberg cut-off was applied to exclude over- and under-reporters.

Information was collected for 244 adolescents with a mean age of 17.5 years ($\pm$ 2.3). The proportion of breakfast intake and skipping was 81% and 19% respectively. The mean breakfast quality score was 3.1 out of a possible score of 5, indicating moderate breakfast quality which incorporates one of the Australian Guide to Healthy Eating (AGHE) food groups. Breakfast intake was influenced by race, and breakfast quality was influenced by participation in physical activity. Breakfast eaters and skippers showed no significant difference in diet quality score. Breakfast quality score was marginally associated with calcium intake ($p < 0.0001$; $r = 0.418$), phosphorous intake ($p < 0.0001$; $r = 0.378$) and total diversity score ($p < 0.0001$; $r = 0.369$). The foods most frequently consumed at breakfast were bread, milk, ready-to-eat cereal (RTEC) and maize porridge.

In conclusion, breakfast skipping proportion was consistent with published South African data. The quality of the breakfast consumed among adolescents in the present study was moderate. Cultural and socio-environmental factors may influence breakfast intake and breakfast quality among adolescents. Breakfast intake did not influence diet quality, but the intake of certain foods at breakfast improved the mean scores for components of the DQI-R and improved the intake of key nutrients. It is recommended that the governmental departments responsible for the Integrated School Health Policy (ISHP) incorporate breakfast messaging into the nutrition education component of the ISHP. Facilitators involved in implementing the ISHP, such as School-based support teams, teachers and healthcare professionals are encouraged to continue the promotion of breakfast intake among adolescents.

Key words: Adolescent; Breakfast; Breakfast quality; Diet Quality; Adolescence

Opsomming

Gereelde ontbyt inname onder adolessente is verwant aan 'n afname in die risiko vir obesiteit en chroniese siekte toestande, verbeterde kognitiewe ontwikkeling en verbeterde nutrient inname. Ten spyte hiervan is daar duidelike bewyse in die literatuur dat die ontbyt inname van adolessente wereldwyd afneem. Adolessente is veral 'n hoe risiko groep as dit kom by gewoontes wat gesondheid bedreig. Dit sluit in 'n toename in kitskos, verhoogde sedentere aktiwiteitsvlakke en gereelde ontbyt oorslaan patrone. Navorsing wys dat leefstyl en gedragsgewoontes wat in adolessensie begin meestal voortgesit word in die volwasse lewe.

Die gerapporteerde ontbyt inname onder adolessente van Suid-Afrika wissel van 13 – 36%. Daar is egter nog min inligting rakende ontbyt gewoontes van Suid-Afrikaanse adolessente.

Deur die ontbyt gewoontes en die meganisme van hoe ontbyt positiewe gesondheid uitkomst te beïnvloed te bestudeer, ontwikkel daar 'n duidelike begrip van die grootte van die probleem wat aangespreek moet word en so kan effektiewe aanbevelings vir publieke gesondheid gemaak word.

Die doel van die studie is om die voorkoms en die kwaliteit van ontbyt inname onder adolessente, in publieke skole in die Noordwes Provinsie, te bepaal. Verder word die effek van ontbyt inname en die kwaliteit van algehele diet-kwaliteit en ander lewenstyl-faktore ondersoek.

Hier word gebruik gemaak van 'n dwarsdeursnit kwantitatiewe ontwerp. Adolessente van graad nege tot elf van sewe publieke sekondêre skole regdeur alle groepe in die Noordwes Provinsie van Suid-Afrika is ewekansig gekies en ingesluit in die studie ($n = 254$). Die studie maak gebruik van herroep opname van 'n demografiese vraelys wat deur die leerder self ingevul is. 'n Enkele 24-uur herroep is gedoen deur gebruik te maak van die vier stap herhaalde metode om informasie rakende ontbyt en diet-inname vir die dag te bepaal. 'n Vraelys oor die tipe ontbyt wat die leerder gewoonlik eet, is ook ingevul. Lengte en massa is deur 'n vlak een antropometris gemeet. Dieet-data is geanaliseer deur gebruik te maak van die Mediese Navorsingsraad van Suid-Afrika se voedsel-samestelling-tabelle. Ontbyt kwaliteit is gemeet

deur die allokasie van 'n ontbyt kwaliteit telling. Die dieet kwaliteit index (DQI-R) is gebruik om die oorhoofse dieet kwaliteit te bepaal. Assosiasies tussen ontbyt-inname en kategorieë veranderlikes is deur die Chi-kwadraat toets of Fisher se eksakte toets gedoen. Spearman korrelasies is gebruik om die assosiasies tussen ontbyt kwaliteit telling en ander deurlopende veranderlikes te toets. Die drumpel vir statistiese betekenisvolheid is gestel op 0.05. Die Goldberg afsny-tegniek is gebruik om oor- en onderrapporteerders uit te skakel uit die dataset.

Inligting vir 244 adolessente met 'n gemiddelde ouderdom van 17.5 jaar (± 2.3) is verkry. Die voorkoms van ontbyt inname en nie-ontbyt inname was onderskeidelik 81% en 19%. Die gemiddelde kwaliteit telling was 3.1 (van 5) wat 'n gemiddelde ontbyt-kwaliteit verteenwoordig wat ten minste een van die Australiese gids tot gesond eet (AGHE) voedsel-groepe insluit. Ontbyt-inname is deur ras beïnvloed en ontbyt-kwaliteit deur fisiese aktiwiteit. Ontbyt-eters en nieëters het nie statistiese betekenisvolle verskille getoon in terme van dieet kwaliteit telling nie. Ontbyt kwaliteit telling was gering geassosieer met kalsium inname, fosfor inname, vleis diversiteit en totale diversiteits telling ($P < 0.001$; $r > 0.369$). Die voedsel wat meer gereeld tydens ontbyt geëet is, was brood, melk en ontbytgraan sowel as mieliepap.

Die voorkoms van ontbyt-inname was in ooreenstemming met gepubliseerde Suid-Afrikaanse data. Die gehalte van die ontbyt verbruik onder tieners in die huidige studie was matig. Kulturele en sosio-omgewingsfaktore mag ontbyt-inname en ontbyt gehalte onder tieners beïnvloed. Ontbyt-inname het nie dieet-gehalte beïnvloed nie, maar die inname van sekere voedselsoorte vir ontbyt verbeter die gemiddelde tellings vir komponente van die groep Goedkeur & Kwaliteitsverbetering-R en die verbetering van die inname van die belangrikste voedingstowwe. Professionele gesondheidsorg werkers word aangemoedig om met die bevordering van ontbyt inname onder tieners voort te gaan.

Sleutel woorde: Adolescent; Ontbyt, Ontbyt-gehalte; Dieet-Kwaliteit

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Acronyms and abbreviations

AGHE	Australian Guide to Healthy Eating
AI	Adequate Intake
BMI	Body Mass Index
BMR	Basal Metabolic Rate
CCK	Cholecystokinin
DQI	Diet Quality Index
DQI-R	Diet Quality Index Revised
EAT	Eating Among Teens
EI	Energy Intake
et al	and others
FBDG	Food Based Dietary Guideline
g	Gram
GI	Glycaemic Index
HDI	Healthy Diet Indicator
HDL-C	High Density Lipoprotein Cholesterol
HEI	Healthy Eating Index
ISAK	The International Society for the Advancement of Kinanthropometry
ISHP	Integrated School Health Policy
kcal	Calorie
kg	kilogram
LDL	Low Density Lipoprotein
MDS	Mediterranean Diet Scale
m ²	Squared meters

mg	Milligram
Non-RTEC	Non-ready-to-eat cereals
NSNP	National School Nutrition Programme
NWU	Northwest University
PAL	Physical Activity Level
RDA	Recommended Dietary Allowance
RTEC	Ready-to-eat cereal
SANHANES	South African National Health and Nutrition Examination Survey
SD	Standard Deviation
SES	Socio-economic status
UK	United Kingdom
US	United States of America
TPB	Theory of Planned Behaviour

Chapter 1 – Introduction



The photograph above has been used with permission and shows a fieldworker in the process of conducting a 24-hour recall at quintile 5 school.

1.1 Problem statement and motivation

Adolescence is a period of marked rapid growth and development, and individuals going through this life stage are considered to be nutritionally vulnerable (Spear, 2002). Adolescence is a unique time of physiologic, psychosocial and cognitive development causing energy and nutrient requirements to be higher (Heald & Gong, 1999). In addition to this, adolescents are strongly influenced by macro- and micro- environmental characteristics, such as family, peers, social eating culture and mass media, influencing their eating habits and behaviour (Moreno *et al.*, 2010; Story *et al.*, 2002). Eating behaviours developed in adolescence often manifest into adulthood and can affect long-term health outcomes including risk for osteoporosis, cardiovascular diseases and cancer (Centres for Disease Control and Prevention, 1996; Lytle, 2003; Mikkila *et al.*, 2005). Adolescent eating behaviour has been associated with more frequent snacking, eating food away from home, increased consumption of ready-to-eat foods or foods of poor nutritional quality, increased engagement in unhealthy weight loss practices and meal skipping, especially breakfast skipping (Frech, 2012; Niemeier *et al.*, 2006; Story *et al.*, 2002). Little research has been conducted to assess the dietary intake of adolescents in developing countries, such as South Africa (Temple *et al.*, 2006; Walker *et al.*, 1982).

It has been suggested that not only the intake of breakfast, but also the quality of the breakfast consumed, may influence the rest of the day's intake thereby further improving overall diet quality (Nicklas *et al.*, 1998). Stephens and Summar (2008) suggested that the quality or types of foods consumed at breakfast may have an effect on diet quality and food choices for the rest of the day. For example, consumption of wholegrain foods, fruit and low-fat dairy products as well as inclusion of high fibre foods contributes to satiety and an overall healthful diet (Stephens & Summar, 2008). There is a need to understand the role of breakfast intake and breakfast quality in influencing overall diet quality, as this information will guide public health recommendations for adequate breakfast intake. In South Africa, Kruger *et al.* (2002) conducted a review to assess the importance of breakfast in helping South African children to meet their nutritional requirements. The review found that breakfast intake was important in helping schoolchildren to meet their nutritional requirements and that the quality of the diet can be improved with regular breakfast consumption. No studies measuring the impact of breakfast quality on overall diet quality among South Africans have been published to date to the knowledge of the author.

Several mechanisms explaining the role of breakfast intake in influencing beneficial health outcomes have been suggested. Breakfast skipping may influence the remainder of the day's intake through increased risk for skipping meals, increased consumption of snacks or consumption of larger meal portions throughout the day (Dejong *et al.*, 2009; Levin & Kirby, 2012). In this way, breakfast intake may be protective against poor dietary behaviours which

follow in the day, helping to prevent individuals from engaging in dietary behaviour linked to obesity and chronic disease risk. In other words, breakfast intake may improve overall diet quality, in turn predisposing an individual to positive health outcomes.

The individual and environmental influences to which adolescents are exposed during the critical phase of transition from childhood to adulthood can affect food choices and dietary behaviour (Pearson *et al.*, 2009). By understanding the factors underlying breakfast skipping behaviour, more effective and relevant strategies to improve the behaviour can be implemented (de Moraes *et al.*, 2012; Story *et al.*, 2002). In South Africa, little research has been conducted to understand the drivers of breakfast skipping behaviour. It has been suggested that race, age and gender may be predictors of breakfast intake among South African adolescents, but these characteristics have not had a consistent impact across the studies published (Feeley *et al.*, 2012; Shisana *et al.*, 2013; Walker *et al.*, 1982). Reasons for breakfast skipping have been reported, including not having enough time to eat in the morning and families not eating together in the mornings (Stupar *et al.*, 2012; Walker *et al.*, 1982). Further research is required to understand the predictors and drivers of breakfast behaviour among adolescents in the South African context.

In adolescents, breakfast intake has been linked to decreased risk for obesity and cardiovascular disease, improved cognition, improved nutrient intake and has been shown to have behavioural and psychological importance (Deshmukh-Taskar *et al.*, 2010; Giovannini *et al.*, 2010; Jaaskelainen *et al.*, 2012; Nicklas *et al.*, 1993; O'Dea & Mugridge, 2012; Ortega *et al.*, 1998a; Sandercock *et al.*, 2010; Smith *et al.*, 2010; Timlin & Pereira, 2007). Adolescents who skip breakfast are essentially missing an opportunity for improved wellbeing, and it is recommended that health practitioners promote healthy breakfast consumption among this particular target group (Rampersaud, 2008).

Despite this, breakfast intake among adolescents is declining (Cho *et al.*, 2003; Rampersaud *et al.*, 2005; Seiga-Riz *et al.*, 2000). In South Africa, research reporting breakfast behaviour among adolescents is limited, although the South African National Health and Nutrition Examination Survey (SANHANES) published in 2013 indicated that 19% of children aged 10 to 14 years do not eat breakfast before going to school (Shisana *et al.*, 2013). Temple *et al.* (2006) reported that 22% of adolescents attending secondary schools in Cape Town skipped breakfast, and similarly, Feeley *et al.* (2012) showed the prevalence of breakfast skipping in Gauteng to be 24%, 36% and 35% for adolescents aged 13, 15 and 17 years respectively. To the author's knowledge, research on the prevalence of breakfast intake among adolescents in other provinces of South Africa has not been published. For this reason, there is a need to

investigate the prevalence of breakfast intake among different adolescent population groups in South Africa, including adolescents in the Northwest Province.

By understanding the prevalence of breakfast skipping and quality of breakfast consumed within a particular target group, research is able to create an understanding of the magnitude of the problem to be addressed. An understanding of how breakfast intake and quality influences diet quality and health outcomes will help to guide effective recommendations for breakfast intake which can be used in public health guidelines and intervention programmes (Ortega *et al.*, 1998b). Figure 1 below summarises the problem statement and motivation for the present research.

Background observation	Regular breakfast consumption is an important indicator of a healthy lifestyle, yet the frequency of breakfast intake among adolescents is declining globally.	
Significance of this finding	In adolescents, breakfast intake has been linked to decreased risk for obesity and cardiovascular disease, improved cognition, improved nutrient intake and has been shown to have behavioural and psychological importance.	
The issue to be addressed	Given the importance of breakfast, especially among adolescents, interventions are required to encourage more frequent breakfast intake within this target group.	
Information required to guide effective recommendations	Understanding the prevalence of breakfast intake and the quality of the breakfast currently being consumed.	Understanding how breakfast intake and quality helps to improve overall diet quality.
Why is this information required?	Will help to understand the magnitude of the problem to be addressed.	Will help to understand the mechanism by which breakfast intake influences positive health outcomes.
Information currently available for South African adolescents	Studies have been conducted in various adolescent population groups,	Research shows breakfast may help to improve intake of nutrients, and therefore may improve overall diet quality.
Motivation for research	Current research is not reflective of the entire adolescent population, or that of the Potchefstroom and its surrounding areas.	Research investigating the effect of breakfast intake on diet quality is lacking among South African adolescents.

Figure 1 Summary of the problem statement and motivation for research

1.2 Research aim, objectives and hypotheses

1.2.1 Aim

The main aim of this study was to investigate the proportion and quality of breakfast intake, and to understand the effect of breakfast intake and quality on overall diet quality among adolescents attending public secondary schools in Potchefstroom and its surrounding areas in the Northwest Province.

1.2.2 Objectives

The primary objectives of this research were:

- To determine the proportion of adolescents who consumed breakfast.
- To assess the quality of the breakfast consumed.
- To determine the effect of breakfast intake and quality on overall diet quality for the day.

Secondary objectives of this research were:

- To determine socio-demographic factors associated with breakfast intake and quality.
- To determine the effectiveness of breakfast intake and quality on the adolescents' BMI.

1.2.3 Hypotheses

The research hypotheses were as follows:

- The prevalence of breakfast skipping among adolescents attending public secondary schools in Potchefstroom and its surrounding areas would be approximately 20%.
- The mean breakfast quality score for the study population would reflect a poor quality breakfast.
- Breakfast intake and a higher breakfast quality score would result in a higher diet quality score for adolescents for the day.
- Age, gender, race, tobacco use, alcohol use and participation in physical activity would be associated with breakfast intake and quality.
- Adolescents with higher breakfast intake and quality scores would have more favourable BMI.

1.3 Structure of the dissertation

This dissertation is written in article format and is made up of four chapters. This first chapter is an introductory chapter which provides context to the research question to be answered. It consists of the problem statement, aims, objectives, a description of the dissertation's structure and the authors' contributions to the research. The second chapter is a review of available literature on the topic, explaining the importance of breakfast intake among adolescents and describing proposed mechanisms for the observed benefits. The literature review describes the process of measuring breakfast and diet quality, summarises the trends in breakfast intake among adolescents globally, and proposes a conceptual framework summarising the factors influencing breakfast intake among adolescents globally based on a review of previous studies. The third chapter is the article entitled "The intake and quality of breakfast consumption among adolescents attending public secondary schools in the Northwest Province, South Africa." This article has been written according to the guidelines stipulated by the *Journal of Adolescence* and will be submitted for publication. The fourth chapter is a conclusion chapter, which will summarise the main findings of the dissertation, and make recommendations for future research. A reference list is provided at the end of each chapter. All references are written in Harvard Style as per the requirements of the North-West University, except for the reference list in chapter 3, which are written according to the requirements of the *Journal of Adolescence* (Appendix F).

1.4 Contribution of the authors

A team of researchers contributed to this research, and the various contributions of the researchers are summarised in Table 1 below.

Table 1 Contributions and roles of research team members

Researcher name and qualification	Contribution to the research
Dr Chrisna Botha	Project supervisor; provided guidance and supervision of the project planning, implementation and analysis of results.
Prof Johann Jerling	Project co-supervisor; provided guidance and supervision of the project.
Ria Laubscher	Project statistician; assisted with analysing and interpreting the results.

Researcher name and qualification	Contribution to the research
Leanne Tee (M.Sc. student)	Primary researcher in the project, responsible for conducting the study, including the planning and collecting of data, writing the literature review, data-analysis and interpretation and writing up of the research results.

1.5 Solemn declaration

I declare that my above-mentioned role in the study is representative of my actual contribution and I hereby give my consent that it be published as part of the M.Sc. dissertation of Leanne Tee.

1.6 References

Centres for Disease Control and Prevention. 1996. *Guidelines for school health programs to promote lifelong healthy eating.*

Cho, S., Dietrich, M., Brown, C., Clark, C. & Block, G. 2003. The effect of breakfast type on total daily energy intake and body mass index: results from the Third National Health and Nutrition Examination Survey (NHANES III) . *Journal of the American College of Nutrition*, 22:296-302.

de Moraes, A.C.F., Adami, F. & Falcao, M.C. 2012. Understanding the correlates of adolescents' dietary intake patterns. A multivariate analysis. *Appetite*, 58:1057-1062.

Dejong, C.S., van Lenthe, F.J., van der Horst, K. & Oenema, A. 2009. Environmental and cognitive correlates of adolescent breakfast consumption. *Preventive Medicine*, 48:372-377.

Deshmukh-Taskar, P.R., Nicklas, T.A., O'Neil, C.E., Keast, D.R., Radcliffe, J.D. & Cho, S. 2010. The Relationship of Breakfast Skipping and Type of Breakfast Consumption with Nutrient Intake

and Weight Status in Children and Adolescents: The National Health and Nutrition Examination Survey 1999-2006. *Journal of the American Dietetic Association*, 110 (6) :869-878.

Feeley, A., Musenge, E., Pettifor, J.M. & Norris, S.A. 2012. Changes in dietary habits and eating practices in adolescents living in urban South Africa: The birth to twenty cohort. *Nutrition*, 28:e1-e6.

Frech, A. 2012. Healthy behaviour trajectories between adolescence and young childhood. *Advances in Life Course Research*, 17:59-68.

Giovannini, M., Agostoni, C. & Shamir, R. 2010. Symposium overview: Do we all eat breakfast and is it important? *Critical Reviews in Food Science and Nutrition*, 50 (2) :97-99.

Heald, F. & Gong, E. 1999. Diet, nutrition and adolescence. Baltimore: Williams and Wilkins.

Jaaskelainen, A., Schwab, U., Kolehmainen, M., Pirkola, J., Jarvelin, M. & Laitinen, J. 2012. Associations of meal frequency and breakfast with obesity and metabolic syndrome traits in adolescents of Northern Finland Birth Cohort 1986. *Nutrition, Metabolism & Cardiovascular Diseases*:1-8.

Kruger, HS., Dhansay, M., Labadarios, D., Kotiah, M. & Kullman, L. 2002. The importance of breakfast in meeting nutritional requirements of South African children. *South African Journal of Clinical Nutrition*, 15 (1) .

Levin, K.A. & Kirby, J. 2012. Irregular breakfast consumption in adolescence and the family environment: Underlying causes by family structure. *Appetite*, 59:63-70.

Lytle, L. 2003. Nutritional issues for adolescents. *Best Practice and Research. Clinical Endocrinology and Metabolism*, 17:177-189.

Mikkila, V., Rasanen, L., Raitakari, O., Pietinen, P. & Viikari, J. 2005. Consistent dietary patterns identified from childhood to adulthood. The Cardiovascular Risk in Young Finns Study. *British Journal of Nutrition*, 93:923-931.

Moreno, L., Rodriguez, G., Fleta, J., Bueno-Lozano, M., Lazaro, A. & Bueno, G. 2010. Trends of dietary habits in adolescents. *Critical Reviews in Food Science and Nutrition*, 50:106-112.

Nicklas, T., Bao, W., Webber, L. & Bereson, G. 1993. Breakfast consumption affects adequacy of total daily intake in children. *Journal of the American Dietetic Association*, 93:886-891.

Nicklas, T.A., Myers, L., Reger, C., Beech, B. & Berenson, G.S. 1998. Impact of Breakfast Consumption on Nutritional Adequacy of the Diets of Young Adults in Bogalusa, Louisiana: Ethnic and Gender Contrasts. *Journal of the American Dietetic Association*, 98 (12) :1432-1438.

Niemeier, H.M., Raynor, H.A., Lloyd-Richardson, E.E., Rogers, M.L. & Wing, R.R. 2006. Fast Food Consumption and Breakfast Skipping: Predictors of Weight Gain from Adolescence to Adulthood in a Nationally Representative Sample. *Journal of Adolescent Health*, 39:842-849.

O'Dea, J.A. & Mugridge, A.C. 2012. Nutritional quality of breakfast and physical activity independently predict the literacy and numeracy scores of children after adjusting for socioeconomic status. *Health Education Research*, 2012:1-11.

Ortega, R., Requejo, A. & Lopez-Sobaler, A. 1998a. Differences in the breakfast habits of overweight, obese and normal weight school children. *Int J Vitam Nutr Res*, 68:125-132.

Ortega, R.M., Requejo, A.M., Navia, B., Lopez-Sobaler, A.M., Quintas, M.E., Andres, P., et al. 1998b. The relationship between the consumption of an inadequate breakfast and energy profile imbalance in preschool children. *Nutrition Research*, 18 (4) :703-712.

Pearson, N., Briddle, S.J. & Gorely, T. 2009. Family correlates of breakfast consumption among children and adolescents: A systematic review. *Appetite*, 52:1-7.

Rampersaud, G. 2008. Benefits of breakfast for children and adolescents: Update and recommendations for practitioners. *American Journal of Lifestyle Medicine*, 3:86-103.

Rampersaud, G., Pereira, M., Girard, B., Adams, J. & Metz, J. 2005. Breakfast habits, nutritional status, body weight and academic performance in children and adolescents. *Journal of the American Dietetic Association*, 105:743-760.

Sandercock, G., Voss, C. & Dye, L. 2010. Associations between habitual school-day breakfast consumption, body mass index, physical activity and cardiorespiratory fitness in English schoolchildren. *European Journal of Clinical Nutrition*, 64:1086-1092.

Seiga-Riz, A.M., Popkin, B.M. & Carson, T. 2000. Differences in food patterns at breakfast by sociodemographic characteristics among a nationally representative sample of adults in the United States. *Preventive Medicine*, 30:415-424.

Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., et al. 2013. South African National Health and Nutrition Examination Survey (SANHANES-1) . Cape Town: HSRC Press.

Smith, K.J., Gall, S.L., McNaughton, S.A., Blizzard, L., Dwyer, T. & Venn, A.J. 2010. Skipping breakfast: longitudinal associations with cardiometabolic risk factors in the Childhood Determinants of Adult Health Study. *American Journal of Clinical Nutrition*, 92:1316-1325.

Spear, B. 2002. Adolescent growth and development. *Journal of the American Dietetic Association*, 102:123-129.

Stephens, K. & Summar, S. 2008. Dietary interventions for the treatment of obese children and adolescents. *Progress in Pediatric Cardiology*, 25:137-141.

Story, M., Neumark-Sztainer, D. & French, S. 2002. Individual and environmental influences on adolescent eating behaviours. *Journal of the American Dietetic Association*, 102 (3) :S40-S51.

Stupar, D., Eide, W.B., Bourne, L., Hendricks, M., Iversen, P.O. & Wandel, M. 2012. The nutrition transition and the human right to adequate food for adolescents in the Cape Town metropolitan area: Implications for nutrition policy. *Food Policy*, 37:199-206.

Temple, N.J., Steyn, N.P., Myburgh, N.G. & Nel, J.H. 2006. Food items consumed by students attending schools in different socioeconomic areas in Cape Town. *Nutrition*, 22:252-258.

Timlin, M.T. & Pereira, M.A. 2007. Breakfast frequency and quality in the etiology of adult obesity and chronic diseases. *Nutrition Reviews*, 65 (6) :268-281.

Walker, A., Walker, B., Jones, J. & Ncongwane, J. 1982. Breakfast habits of adolescents in four South African populations. *American Journal of Clinical Nutrition*, 36 (4) :650-656.

Chapter 2 – Literature review



The photograph above has been used with permission and shows the team of fieldworkers who assisted with data collection for this project.

2.1 Introduction

Globally it is well accepted that regular breakfast consumption is an important indicator of a healthy lifestyle (Rampersaud *et al.*, 2005). In fact, the seminal “Alameda 7” study conducted by Belloc and Breslow (1972) identified breakfast as one of the seven healthy habits which contribute to long term health. Regular breakfast intake has been associated with improved diet quality (Kruger *et al.*, 2002; Nicklas *et al.*, 2000), healthier body weight (Horikawa *et al.*, 2011; Panagiotakos *et al.*, 2008) and decreased risk for chronic diseases (Di Giuseppe *et al.*, 2012) when compared with breakfast skipping in both adults and children. Breakfast consumption is consistent with healthful lifestyle habits and overall improvements in healthy lifestyle indicators.

Despite the proven benefits of breakfast, research shows that the frequency of breakfast consumption is declining (Haines *et al.*, 1999). This trend is being observed among adolescents and young adults globally (Cho *et al.*, 2003; Rampersaud *et al.*, 2005; Seiga-Riz *et al.*, 2000). Given the importance of breakfast and the evident prevalence of skipping among adolescents, interventions are required to encourage more frequent breakfast intake within this target group (Breuning *et al.*, 2011; Kothe *et al.*, 2011).

Over time, the quality and types of foods typically eaten for breakfast have changed (Moshfegh *et al.*, 2002). These changes could be attributed to urbanisation, Westernisation and globalisation in different countries which influences the food supply made available to the public, thus in turn affects food choices (Steyn *et al.*, 2006). Research has indicated that the type of breakfast consumed may influence diet quality, food choices throughout the rest of the day and overall health outcomes (Deshmukh-Taskar *et al.*, 2010; Leidy, 2012). For this reason, it is not only the prevalence of breakfast consumption or skipping, but also the quality of the breakfast consumed that should be taken into account when advising recommendations for breakfast intake.

By understanding the prevalence of breakfast skipping and quality of breakfast consumed within a particular target group, research is able to create an understanding of the magnitude of the problem to be addressed. An understanding of how breakfast intake and quality influences healthy lifestyle behaviours and outcomes will help to guide effective recommendations for breakfast intake which can be used in public health guidelines and intervention programmes (Ortega *et al.*, 1998b). And lastly, an understanding of factors associated with breakfast consumption will help to formulate recommendations which are relevant to the target group (Breuning *et al.*, 2011).

The purpose of this literature review is to review the evidence highlighting the importance of breakfast among adolescents, assess the prevalence of breakfast intake globally, to understand the literature explaining the possible link between breakfast skipping and quality and overall diet quality, determine the factors associated with breakfast intake and to understand breakfast intake behaviour among adolescents in South Africa.

2.2 The definition of “breakfast”

The term “breakfast” is an English noun which originated in the 15th century. It was the contraction of the phrase “to break (verb) (the) fast (noun)” indicating that overnight while one slept, one was not able to eat, and that shortly after awakening one would need to break the fast with a meal (Anon, 2013).

Since there is no universal definition for the term “breakfast”, individual studies have developed their own definitions depending on their study objectives. According to Rampersaud (2008), there are three key considerations for defining the breakfast eating occasion, namely the type of food consumed, the amount of food consumed and the time of day when the food is consumed. These considerations are outlined in Figure 1 below.

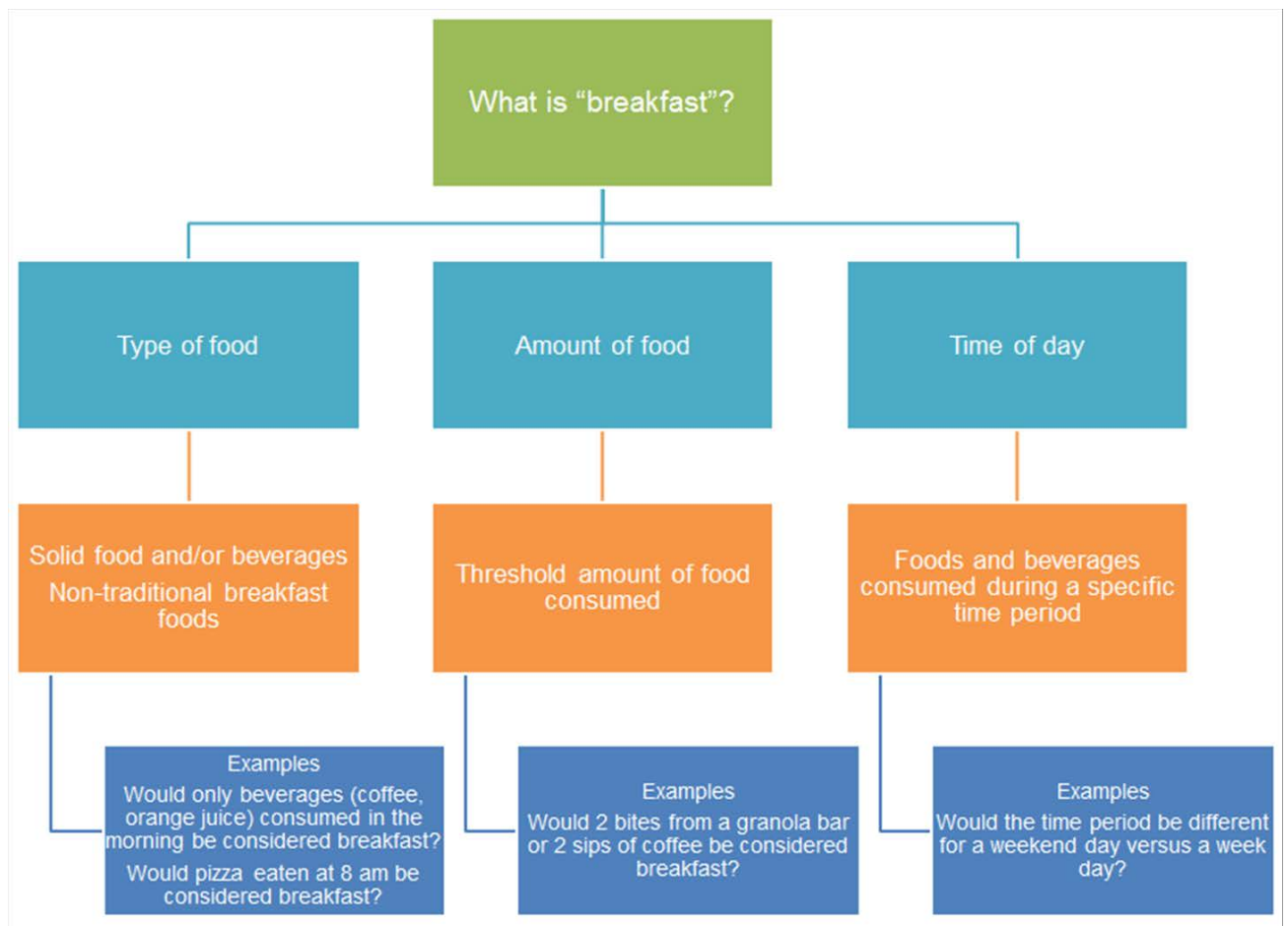


Figure 1 Considerations for how breakfast is defined ~ adapted from Rampersaud (2008)

Differing definitions for breakfast across studies makes it difficult to compare results and research findings. Table 1 below summarises the definitions of breakfast used in a handful of studies assessing breakfast intake. The table clearly shows the variety in the types of definitions which can exist across studies.

Table 1 Various definitions for breakfast

Reference	Definition for breakfast
Deshmukh-Taskar <i>et al.</i> (2010)	Consumption of any food or beverage at a meal occasion named by the respondent as “breakfast”
Smith <i>et al.</i> (2010)	Eating a snack, small meal or large meal between 6 am and 0900
Alexander <i>et al.</i> (2009)	Any food or beverage consumed between 05:00 and 10:00 hours with a combined total energy ≥ 100 kcal
Albertson <i>et al.</i> (2007)	Any eating that occurred between 5:00 and 10:00 am on weekdays or between 5:00 and 11:00 am during weekends
Matthys <i>et al.</i> (2007)	The first eating occasion involving a solid food or a beverage that occurred after waking
Affenito <i>et al.</i> (2005)	Any eating that occurred between 5 am and 10 am on weekdays or between 5 am and 11 am during weekends
Aranceta <i>et al.</i> (2001)	Any intake of food or beverage between 6 am and 10 am during weekdays and between 6 am and 11 am for the weekends and holidays
Nicklas <i>et al.</i> (2000)	An eating occasion which the student considered to be his or her breakfast
Siega-Riz <i>et al.</i> (1998)	The consumption of a food, beverage, or both between 5 am and 10 am
Haines <i>et al.</i> (1996)	Any food or beverage consumed between 5 am and 10 am for children and between 5 am to 9 am for adults
Ruxton <i>et al.</i> (1996)	A solid item of food taken before attending school or before 11 am at weekends
Gleason (1995)	All foods eaten from the time a student got up in the morning until 45 minutes after the start of school, provided that the total food energy intake from these foods exceeded 50 kcal. If a student’s food energy intake over this period was < 50 kcal, he or she was considered to have skipped breakfast.
Dickie and Bender (1982)	Any solid food taken in the morning before arriving at school

The definitions used most often were “what the study participant perceived to be their breakfast” and “consumption between 5 am and 11 am in the morning”. Some studies

distinguished between whether a solid, beverage or both constituted breakfast, and others allowed slightly different definitions for breakfast intake between weekdays and weekends. Certain studies also included a minimum energy requirement from the breakfast meal in order to be classified as a breakfast. It is also seen that some studies do not take time into account time of consumption at all, but defined breakfast as the first meal consumed after waking. Given that no universal definition for breakfast exists, researchers would need to create their own definition depending on the objectives of their research.

2.3 The importance of breakfast intake among adolescents

The anecdotal term, “breakfast is the most important meal of the day” is often used to encourage breakfast intake among adults and children alike. A wealth of research has documented the association between breakfast and a healthy body weight, protection against cardiovascular diseases, improved diet quality and cognitive performance in children and adolescents (Sandercock *et al.*, 2010). Breakfast is one element of a healthy lifestyle which has been linked to improved health and wellbeing in the long- and short-term. Adolescents who are skipping breakfast are essentially missing an opportunity for improved wellbeing, and it is recommended that health practitioners promote healthy breakfast consumption among this particular target group (Rampersaud, 2008).

Research shows that lifestyle and behaviour habits which are entrenched during adolescence are likely to remain throughout adulthood (Merten *et al.*, 2009). The transition period between adolescence and adulthood appears to be particularly high-risk for weight gain (Frech, 2012; Niemeier *et al.*, 2006). Health-compromising behaviours commonly observed during adolescence include increased fast food consumption, increased sedentary levels and frequent breakfast skipping (Frech, 2012; Niemeier *et al.*, 2006). Broadly speaking, healthy behaviour such as adequate exercise and sleep, maintaining healthy weight, not smoking or binge drinking and eating breakfast regularly decline dramatically during the transition to young adulthood (Frech, 2012). Psychosocial characteristics, social support from schools, peers and caregivers, and family characteristics are all factors to which adolescents are exposed, and play a role in determining the degree to which adolescents engage in health compromising behaviour (Frech, 2012).

Adolescents who skip breakfast or have a breakfast of poor quality, place themselves at risk for poor outcomes of long-term health (Dejong *et al.*, 2009). Given the beneficial outcomes associated with consumption of breakfast, breakfast should form an important part of

adolescents' daily routines (Merten *et al.*, 2009). Below the various benefits of breakfast are discussed, highlighting the need for this important meal among adolescents globally.

2.3.1 The relationship between breakfast consumption and obesity in adolescents

It has been shown that obese adolescents are likely to remain obese adults (Gordon-Larsen *et al.*, 2004) and that lifestyle and behaviour habits which are entrenched during adolescence are likely to remain throughout adulthood (Merten *et al.*, 2009). The transition period between adolescence and adulthood appears to be particularly high-risk for weight gain, as a result of changing lifestyle factors (Frech, 2012; Niemeier *et al.*, 2006).

Research has shown a positive relationship between breakfast intake and healthy body weight; however causality for this relationship has not been established. By understanding the link between breakfast intake and body weight, effective recommendations can be developed to promote healthy breakfast behaviour and lessen the risk for obesity among adolescents.

2.3.1.1 The prevalence of obesity

Adolescent overweight and obesity rates are globally on the rise (Dejong *et al.*, 2009) and this trend is also being observed in South Africa. According to the South African Demographic and Health survey conducted in 2003, 8% of adolescent girls were obese, as were 1% of adolescent boys (Department of Health, 2007). The previously recorded prevalence of obesity among adolescents was 6% and 2% for girls and boys respectively (Department of Health, 2004). According to the South African National Health and Nutrition Examination Survey (SANHANES), 7.5% of boys aged 10 to 14 years were overweight and 2.7% were obese (Shisana *et al.*, 2013). For girls aged 10 to 14 years, 16.7% were overweight and 5.6% were obese. In this age group, girls are significantly more likely to be overweight or obese. For adolescents aged 15 to 17 years, too few cases were recorded to confirm reliably, although this information can be used to indicate a trend in the prevalence of overweight and obesity. For males aged 15 to 17 years, 7.3% and 1.5% were overweight and obese respectively, and for females, 19.3% and 8% were overweight and obese respectively (Shisana *et al.*, 2013). This indicates that the prevalence of obesity among adolescents in South Africa has increased over the last decade for females only, as shown in Figure 2 below.

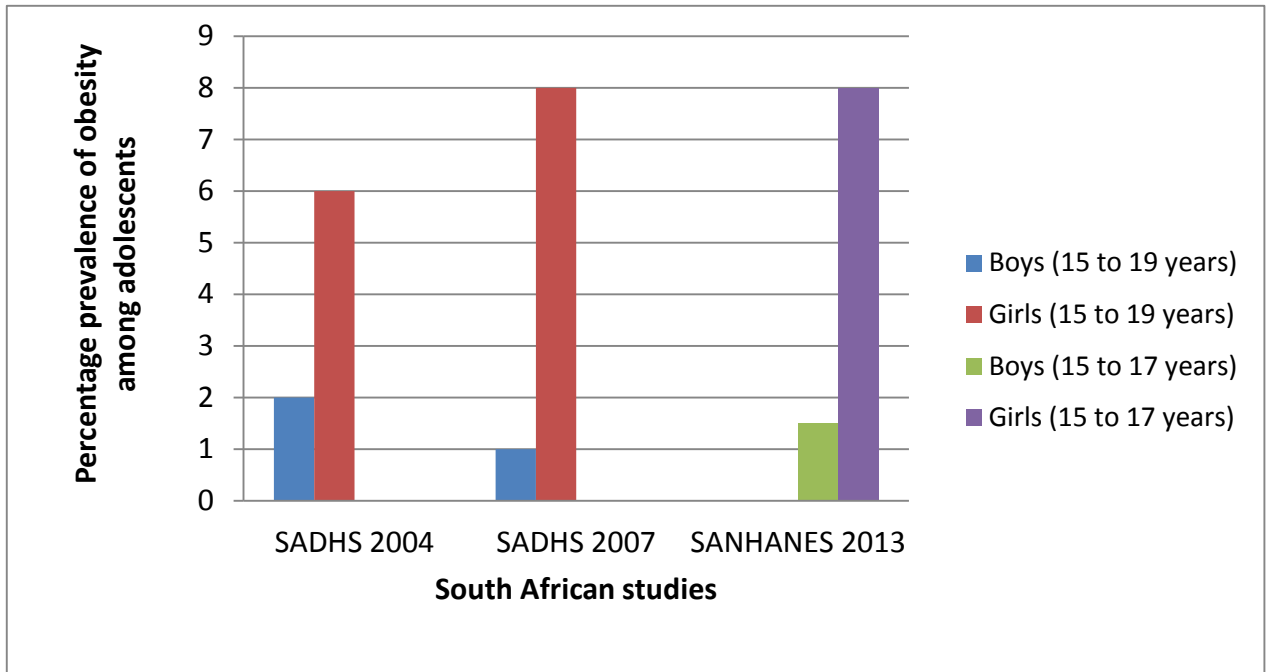


Figure 2 The prevalence of obesity among South African adolescents by gender ~ adapted from Department of Health (2004), Department of Health (2007) and Shisana *et al.* (2013)

2.3.1.2 Evidence for the relationship between breakfast and obesity

Many studies have sought to determine the cross-sectional link between regular breakfast intake and Body Mass Index (BMI). There is a wealth of evidence to support the link between breakfast consumption and healthier BMI among adolescents globally, as found by studies conducted in Iran, Wales, Finland, the US, Greece and England (Deshmukh-Taskar *et al.*, 2010; Elgar *et al.*, 2005; Fiore *et al.*, 2006; Jaaskelainen *et al.*, 2012; Kontogianni *et al.*, 2010; Maddah, 2008; Roseman *et al.*, 2007; Sandercock *et al.*, 2010). Some studies have reported a beneficial effect of breakfast consumption on BMI for males, but not females (Gomez-Martinez *et al.*, 2012; Kent & Worsley, 2010; Veltsista *et al.*, 2010).

In December 2007, the New Expert Committee released recommendations for the assessment, treatment and prevention of childhood and adolescent obesity (Barlow, 2007). The key recommendation for the prevention of obesity among adolescents was identified as regular consumption of breakfast. An analysis of the Third National Health and Nutrition Examination Survey conducted between 1988 and 1994 among adolescents in the US, sought to identify lifestyle factors which were potentially protective against obesity (Fiore *et*

al., 2006). This analysis found that even among adolescents with two obese parents, eating breakfast some days or every day was significantly protective against becoming overweight. Regular breakfast consumption was shown to be the strongest protective factor within the group of adolescents studied.

Roseman *et al.* (2007) assessed breakfast intake among adolescents aged 10 to 14 years in Kentucky, US (n = 4049). The study found that weight status was inversely associated with breakfast frequency and adolescents of normal weight ate breakfast more often than adolescents who were overweight. Fiore *et al.* (2006) analysed US data from the US National Health and Nutrition Examination Survey III (1988-1994), and focussed specifically on adolescents aged 12 to 16 years (n = 1890). Interestingly, no association between breakfast intake and body weight was found among adolescents whose parents were normal weight, but for adolescents with at least 1 obese parent, eating breakfast was associated with a healthier body weight.

Deshmukh-Taskar *et al.* (2010) found that children and adolescents classified as “breakfast skippers” had a higher mean waist circumference than study participants who ate ready-to-eat cereals and other breakfasts regularly. Gomez-Martinez *et al.* (2012) assessed the eating habits and abdominal fat of adolescents in Spain. The study found that among males adolescents, breakfast consumption had a positive influence on skinfold measure and waist circumference (Gomez-Martinez *et al.*, 2012).

Stockman *et al.* (2005) observed breakfast intake and health outcomes among adolescent boys aged 14 to 18 years in Canada. Breakfast intake was measured as a frequency of consuming breakfast over 3 days (breakfast eaten on none (0), 1, 2 or all 3 days). Adolescents who ate breakfast on all the 3 days had a lower BMI than adolescents skipping at least one day.

Project Eating Among Teens (EAT) was a longitudinal US based study (Haines *et al.*, 2007). Breakfast intake was measured by frequency of intake for the previous week. Baseline data was collected from 1998 to 1999, and follow up data was collected in 2003 to 2004. Increased frequency of breakfast consumption at baseline was negatively associated with overweight at follow-up. Improved breakfast frequency at follow up when compared to baseline breakfast frequency was associated with lower odds of overweight at follow up.

A study of 6599 adolescents aged 11 to 13 years was conducted in schools in the United Kingdom (Harding *et al.*, 2008). Breakfast skipping was assessed by frequency per week

(everyday, sometimes or hardly ever). Skipping breakfast sometimes or everyday was associated with increased likelihood for overweight and obesity in boys and girls.

Miller *et al.* (2013) examined the association between breakfast choice and the physiological status of 6729 children aged 2 to 17 years. The study participants were separated into four groups depending on their breakfast habits. These were pre-sweetened cereal eaters, non-pre-sweetened cereal eaters, breakfast skippers and other breakfast eaters (people who ate food other than breakfast cereals for breakfast). The population was analysed in smaller subsets namely young children (aged two to five years), older children (aged six to 11 years) and adolescents (aged 12 – 17 years). Compared to the breakfast skippers and those eating 'other breakfasts', adolescents who ate pre-sweetened breakfast cereals had lower body weight, BMI, BMI percentile, percentage overweight or obesity, waist circumference and subscapular and triceps skinfolds ($p < 0.05$). There were no differences found between the pre-sweetened and non-pre-sweetened groups for any anthropometrics in adolescents aged 12 to 17 years. Fasting serum total cholesterol was lower in adolescents both in the pre-sweetened cereals and non-pre-sweetened cereals groups when compared to the breakfast skipping group but was not different to the 'other breakfasts' group. No differences in fasting serum samples were observed for HDL-C or triglycerides between any of the groups. Again, for blood lipid values, there were no significant differences between the pre-sweetened and non-pre-sweetened cereal groups. The risk of abdominal obesity and being overweight were greater in both the breakfast skipping and 'other breakfast' groups when compared to the pre-sweetened cereals group. Again, no difference was found between the two cereal groups (pre-sweetened and non-pre-sweetened). The study concluded that a positive association exists between breakfast cereal consumption and healthier body weights compared with adolescents who are skipping or eating a non-cereal breakfast (Miller *et al.*, 2013).

Overall, the research indicates a link between breakfast intake and decreased obesity risk, but also suggests that the type of breakfast being consumed may be of importance.

2.3.1.3 The effect of the breakfast type or quality on BMI and obesity risk

The information above raises the question as to whether the link between breakfast intake and decreased obesity risk exists solely because of food consumption at breakfast time, or whether the type of foods consumed at breakfast play a role. It is likely that differences in energy and nutrient content of different types of breakfasts may influence the degree of effectiveness in preventing overweight or obesity (de la Hunty *et al.*, 2013; Rampersaud,

2008). In other words, the quality of the breakfast consumed may also affect health outcomes (Leidy, 2012).

Most published studies which have reported on breakfast intake have focussed on ready-to-eat cereals (RTEC) and little data exists for other types of breakfast foods or formats. This is largely driven by the fact that many breakfast studies have been published in Australia, the United Kingdom and the United States, reflecting the Westernised behaviour of consuming RTEC. According to Deshmukh-Taskar *et al.* (2010), people who eat breakfast cereals tend to consume more micronutrients and dietary fibre, while consuming less dietary fat and cholesterol. Groups of people who do not typically eat breakfast cereals may choose breakfasts which are higher in fat and added sugars, affecting the relationship between breakfast intake and obesity risk (Deshmukh-Taskar *et al.*, 2010; Leidy, 2012). The category of 'other breakfasts' is not limited to wholesome foods and may represent an increasing proportion of foods which are low in nutrient density, such as fizzy drinks, salty snacks and sugary sweets (Miller *et al.*, 2013). Similarly, increasing evidence supports the role of the Glycaemic Index (GI) and protein content when selecting a healthy breakfast. The interest in low GI meals stems from the findings that a low GI breakfast may decrease perceived hunger, improve glucose control and decrease energy intake at the next meal (Pereira *et al.*, 2011). Results regarding the impact of GI on health outcomes are conflicting, and further research is required to establish its role in the diet (Brindal *et al.*, 2012). There is growing interest in the role of protein in the breakfast meal as research suggests that increased protein intake may cause sustained feelings of satiety throughout the morning (Leidy *et al.*, 2009).

The role of breakfast quality in predicting health outcomes should be clearly understood to guide effective public health recommendations and guidelines for breakfast intake. Further research is required in this field.

2.3.1.4 Proposed mechanism of action

The co-occurrence of the rising global obesity epidemic and subsequent decline in breakfast consumption is raising interest in the causal link between breakfast intake and decreased risk for obesity and chronic diseases (Giovannini *et al.*, 2010). Despite the findings of many cross-sectional studies which have demonstrated the link between breakfast intake and reduced risk for obesity, research has not yet confirmed causality between these two variables, although some plausible mechanisms have been suggested.

2.3.1.4.1 Glucose control

Few studies have investigated the effect of breakfast intake on glucose and insulin metabolism. One conducted by Farshchi *et al.* (2005) assessed fasting LDL, cholesterol and insulin sensitivity among women split into 2 groups; the first group was asked to skip breakfast while the second ate a breakfast of 500 calories for 14 days. At the end of the intervention period it was found that breakfast skippers had higher fasting LDL and reduced insulin sensitivity when compared to breakfast eaters. Jovanovic *et al.* (2009) showed similar findings among a group of type 2 diabetic adults. Skipping breakfast lead to compromised glucose control at the next meal when compared to those who ate a breakfast of 650 calories.

The composition of the breakfast consumed may also contribute to the metabolic modifications observed. For example, fibre-rich breakfast foods curb glycaemic and insulin responses after eating, thereby improving insulin sensitivity (Liljeberg *et al.*, 2001; Nestler *et al.*, 1988). The metabolic effects related to glycaemic and insulin response may contribute to satiety among regular breakfast eaters (Liljeberg *et al.*, 2001).

2.3.1.4.2 Appetite control and satiety

Clinical studies in humans have consistently found that increased meal frequency may improve chronic disease risk factors and reduce appetite and intake of energy (Gwinup *et al.*, 1964; Jenkins *et al.*, 1989; Timlin & Pereira, 2007). Research has suggested that breakfast skipping influences the remainder of the day's intake through increased risk for skipping meals or consumption of larger meal portions throughout the day (Dejong *et al.*, 2009; Levin & Kirby, 2012). In other words, breakfast skipping may be the precursor for unfavourable dietary behaviour, such as eating fewer, larger meals as opposed to more frequent smaller meals. Research conducted by Pereira *et al.* (2011) suggests that breakfast may influence satiety thereby controlling appetite and dietary intake. It has been found that consumption of a 500 calorie breakfast leads to significant reductions in perceived appetite after the breakfast was consumed, as well as increasing in the satiety hormone peptide YY (Brindal *et al.*, 2012; Pereira *et al.*, 2011). Breakfast intake was significantly associated with reduced energy intake at lunch. This indicates that breakfast may play a role in satiety, resulting in fewer total calories being consumed overall throughout the day, and thereby contributing to a healthy body weight. Alternatively, complex carbohydrate-containing foods, such as whole grains typically consumed at breakfast, may affect the release and activity of gut hormones, such as cholecystikinin (CCK), which in turn influence satiety (Pereira & Ludwig, 2001). There may also be a role for the production of short chain fatty acids in the gut after the consumption of a high-fibre breakfast, affecting satiety. Short-

chain fatty acids enter the portal circulation, reduce the output of hepatic glucose and free fatty acid serum concentration, and in this way, stimulate glucagon peptide-1 secretion. This may alter insulin sensitivity and secretion patterns, in turn influencing satiety (Flint *et al.*, 2001). This highlights the importance of including fibre-rich foods as part of the breakfast meal to ensure that breakfast elicits its beneficial effects.

The time of day when food is consumed may also affect appetite and satiety. A study conducted by de Castro (2004) sought to understand the relationship between the time of day that food was consumed and the total energy intake for that day. The proportion of food consumed in the morning was negatively correlated with overall intake while the proportion of food consumed later in the day was positively correlated with energy intake. This indicated that more food being consumed in the latter portion of the day may increase the risk for excess energy intake, weight gain and chronic diseases.

It is possible that individuals, who eat breakfast regularly, especially a breakfast which includes cereals and complex carbohydrates, may benefit from a number of interacting physiological mechanisms which reduce appetite and in turn reduce risk for obesity and chronic disease. Both breakfast frequency and quality may influence the physiological changes and health outcomes as shown in Figure 3 below.

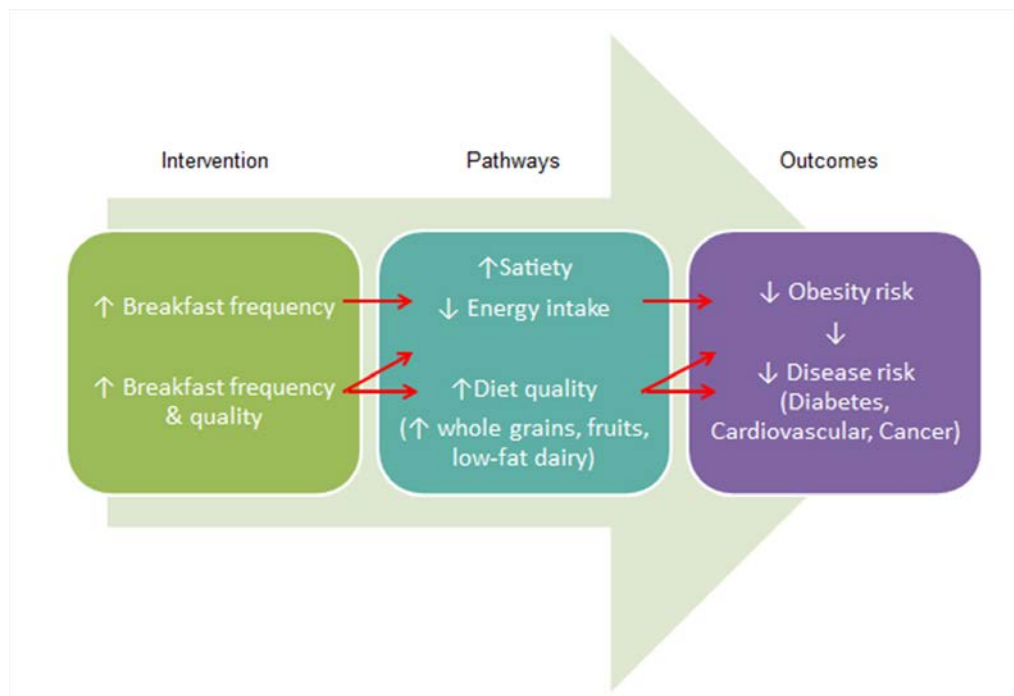


Figure 3 Theoretical model explaining the role of breakfast frequency and quality in reducing the risk of obesity and chronic diseases ~ adapted from Timlin and Pereira (2007)

That said, research has also shown that in many cases, the total energy intake of individuals who eat breakfast may be higher than those who skip breakfast (Rampersaud, 2008). Similarly, studies which found an inverse association between breakfast consumption and adiposity showed that this correlation remains, even after adjusting for energy intakes (de la Hunty *et al.*, 2013). This implies that the effect may be attributed to mediated changes in energy expenditure through increased physical activity or metabolic rate (de la Hunty *et al.*, 2013).

2.3.1.4.3 Physical activity and energy expenditure

In a descriptive survey carried out by Tin *et al.* (2011) to determine the lifestyle and socioeconomic correlates of breakfast skipping among primary school children, the results showed a clear trend towards breakfast skippers participating in less extra-curricular physical activity. Keski-Rahkonen *et al.* (2003) carried out a similar survey to investigate breakfast skipping and health compromising behaviours of adolescents and adults. Infrequent exercise was significantly associated with breakfast skipping in both adolescents and adults. The study further found that adults and adolescents who ate breakfast regularly were more likely to exercise than their breakfast skipping counterparts.

Sandercock *et al.* (2010) investigated the association between habitual breakfast consumption and physical activity among schoolchildren in England. The study found that boys who never ate breakfast were more likely to have lower physical activity odds ratio, and girls were more likely to have low physical activity if they sometimes or never ate breakfast. The study showed a positive association between habitual breakfast consumption and higher physical activity levels in schoolchildren. Similarly, Schembre *et al.* (2013) found that less frequent breakfast consumption was associated with 30% less moderate-to-vigorous intensity physical activity.

In contrast, a cross-sectional survey conducted by Corder *et al.* (2011) among 877 adolescents in Britain found that for boys, there was no significant association between breakfast frequency and physical activity whereas for girls, less frequent breakfast consumption was associated with lower levels of physical activity in the morning. Similarly, a 2-week randomised cross-over trial conducted by Halsey *et al.* (2011) which asked participants to eat breakfast every day for one week and then fast until midday every day in the second week, found no difference in daily energy expenditure between the two experimental conditions.

There is conflicting evidence for the role of breakfast in influencing physical activity level, and further investigation is required to understand the link between these variables.

2.3.2 The relationship between breakfast consumption and chronic disease risk

Similar to the relationship between breakfast intake and lower risk for obesity, research suggests that breakfast consumption also decreases risk for chronic diseases. The research investigating this link is discussed below.

2.3.2.1 Evidence for the relationship

Much of the research regarding breakfast intake and risk for chronic diseases has been conducted among adults. This may be due to the manifestation of chronic disease mostly occurring later in life rather than in childhood. However, behaviours which develop in childhood become precursors for health outcomes in adulthood. Smith *et al.* (2010) analysed data from the Childhood Determinants of Adult Health Study which was conducted in Australia in 1985 among 9 to 15-year old children. At the time, the study assessed frequency of breakfast intake among the children before going to school. In 2004 to 2006, a follow up to the study was conducted, where 2184 adults aged 26 to 36 years were asked to complete a meal frequency chart for the previous day. The purpose of the study was to examine longitudinal associations of breakfast skipping from childhood to adulthood, with specific focus on cardio-metabolic risk factors in adulthood. It was found that participants who skipped breakfast both in childhood and adulthood had a larger mean waist circumference and higher fasting insulin, total cholesterol and LDL cholesterol than those who ate breakfast at both stages of the study. The study concluded that breakfast skipping over the long-term may increase cardio-metabolic health risk (Smith *et al.*, 2010).

Jaaskelainen *et al.* (2012) analysed data collected as part of the Northern Finland Birth Cohort Study which began in 1986. The analysis focused on a sample of 6247 16-year old boys and girls and sought to determine the association between meal frequency and metabolic syndrome traits in these adolescents. The study found that adolescents, who ate five meals per day, including breakfast, were at lower risk for obesity, abdominal obesity and hypertriglyceridaemia (in boys only). The study concluded that the five-a-day meal pattern, including breakfast, was associated with reduced risk of abdominal obesity in boys (Jaaskelainen *et al.*, 2012).

In the Alameda County Study conducted by Kaplan *et al.* (1987) seven risk factors, including breakfast consumption were assessed to determine their impact on mortality in elderly men. The Alameda County Study found that eating breakfast regularly was one lifestyle factor which protected against mortality and death related to cardiovascular disease.

The Physician's Health Study was conducted among normal weight adults in 2003 and assessed breakfast cereal intake and mortality. The study found that regular intake of breakfast cereal, including whole grains, had an inverse relationship with total mortality, mortality due to cardiovascular disease and myocardial infarction (Lui *et al.*, 2003).

The findings reported by the studies cited above support the hypothesis that regular breakfast consumption may reduce chronic disease risk over time, however more definitive, longer and larger randomised trials are required to clarify the role of breakfast frequency and quality in decreasing risk for chronic disease. Plausible mechanisms of effect support this hypothesis (Timlin & Pereira, 2007).

2.3.2.2 Proposed mechanism of action

Research has suggested that increased frequency of meal consumption has resulted in lower day-long insulin concentrations (Farshchi *et al.*, 2005). This in turn results in lower concentrations of total cholesterol and LDL cholesterol. Reduced serum insulin concentration may also inhibit cholesterol production by the liver through the inhibition of 3-hydroxy-3-methyl-glutaryl-CoA reductase. Frequent meals also promote prolonged suspension of free fatty acids in the serum, gastric inhibitory peptide and growth hormone.

These findings indicate that frequent meal intake, including the regular intake of breakfast, may reduce the risk of developing chronic diseases linked to lipid concentrations such as cardiovascular disease and diabetes. Taking this evidence into account, Timlin and Pereira (2007) suggest that frequent meals, including breakfast, are associated with improved glycaemia, insulinaemia and lipidaemia.

2.3.3 Breakfast and cognition in adolescents and children

Breakfast is widely promoted for its role in improving cognitive function and academic performance and a wealth of research has investigated the importance of eating breakfast in supporting this outcome.

2.3.3.1 Evidence for the relationship

In a cross-sectional survey of 824 children in grades three to seven in Australia, O'Dea and Mugridge (2012) investigated the relationship between breakfast quality and literacy and numeracy scores in these children. The study showed that breakfast quality had a positive relationship with literacy scores as measured by mandatory government tests using the standardised National Assessment Program for Literacy and Numeracy (O'Dea & Mugridge, 2012). The study did mention that it may be more difficult to see the effect of breakfast

quality on literacy or numeracy scores among children who were well nourished, and the degree of association may be greater among children with nutrient deficiencies (O'Dea & Mugridge, 2012).

Maffeis *et al.* (2012) compared the effect of eating breakfast vs. fasting on metabolic and cognitive consequences among a group of pre-pubertal obese children in Italy. Half of the children were given only water on the morning of assessment, and half were given a breakfast of whole milk, toasted bread and marmalade. The study showed that mental performance was reduced in children who skipped breakfast as shown by reduced attentive and verbal memory performance. This finding was associated with reduced carbohydrate oxidation among participants who fasted (Maffeis *et al.*, 2012).

In 2009, a systematic review of the available literature was conducted to determine the effect of breakfast on cognitive performance of children and adolescents (Hoyland *et al.*, 2009). The review included a total of 45 studies, 28 of which measured the acute effects of breakfast intake on cognitive performance, and 13 of which examined the long term effects of school breakfast programs. The remaining four studies examined the effect of habitual breakfast intake on cognitive performance. Only 10 of the 45 studies focussed on adolescents over the age of 13-years. Among the studies of the acute effects of breakfast intake conducted among well-nourished children, the majority demonstrated positive effects of breakfast when compared to no breakfast. The positive effects were most evident on measures of memory and attention tasks. The strongest effects of breakfast intake were found in the late morning. When comparing the acute effects of breakfast among children with differing nutritional status, some studies reported that cognitive performance was better after breakfast intake among the under-nourished group vs. the well-nourished group, indicating that under-nourished children may benefit more than nourished children would. Of the long-term studies reviewed, none considered the effect of breakfast intake on cognition in adolescents. However, when viewed together, the long-term studies showed a positive effect of breakfast on mathematics and arithmetic scores, probably due to increased school attendance and decreased absenteeism. The review concluded that overall, breakfast consumption may have positive effects on cognitive performance when compared to breakfast skipping, as shown in both acute and longer-term studies. However, the available research did not provide sufficient information to formulate a recommendation for optimal breakfast to support cognition. Furthermore, the studies tended to focus on memory and attention performance where other domains of cognitive performance, such as problem solving of psychomotor skills are less researched (Hoyland *et al.*, 2009).

2.3.3.2 *The effect of breakfast quality on cognitive function*

The role of breakfast type and quality in determining the influence of breakfast on academic performance is an important factor to consider.

In 2003, the effect of breakfast quality on scholastic aptitude (verbal reasoning and calculation ability) was measured among 180 children aged 9 to 13 years in Spain (Lopez-Sobaler *et al.*, 2003). The study defined two categories of breakfast quality. The first was “adequate” (more than 20% of the daily energy requirements) and the second, “inadequate” (less than 20% of the daily energy requirement). The quality or adequacy of breakfast in this case was based solely on contrition of energy to total energy requirements and did not take any other nutrients or factors into account. The study found that “adequate” breakfast quality was associated with better performance. For children with low scholastics aptitude scores, 66% had inadequate breakfast intake (Lopez-Sobaler *et al.*, 2003).

In 2006, a study of 141 children aged 12 to 13 years was undertaken in Spain to determine relationship between scholastic performance and breakfast quality. Breakfast quality was assessed as good (at least one dairy, cereal and fruit), improvable (lacks one food group), insufficient (lacks two food groups) and no breakfast. The study measured scholastic performance against different quality groups of habitual breakfast intake and found that higher end-of-year marks were associated with increased breakfast quality (Herrero & Fillat, 2006).

A third study was conducted among Spanish school children aged 12 to 17 years in 2008. Scholastic performance was compared to quality of habitual breakfast intake. The breakfast quality groups were defined as optimal (25% of daily energy requirements, dairy, cereals, fruits and fats), good (dairy, cereals, fruits and fats), adequate (one food group missing), inadequate (two food groups missing) and no breakfast. The study found that better breakfast quality was associated with better mean scholastic performance score (Morales *et al.*, 2008).

In the research conducted by O'Dea and Mugridge (2012), one of the objectives was to determine the impact of the nutritional quality of breakfast in predicting literacy and numeracy scores for 824 children in grades three to seven. A breakfast quality score of 1 to 10 was allocated depending on the breakfast consumed on the day of data collection. A score of zero indicated the lowest possible score if the student had nothing to eat or drink for breakfast, and the highest possible score of 10 was allocated if a student's breakfast contained all 5 of the major food groups, as well as a source of vitamin C, calcium and low

fat milk. The study found that the quality of the breakfast had an independent and positive impact on literacy scores.

These findings emphasise the need to define the optimal breakfast when making public recommendations for breakfast intake, as breakfasts of a higher quality score are associated with improved scholastic performance.

2.3.3.3 Proposed mechanism of action

Studies have suggested that glucose ingestion facilitates cognitive performance (Maffeis *et al.*, 2012). This is due to brain activity using glucose as its main source of fuel (Chugani, 1998). However, the degree of glucose utilisation varies depending on the age of the person being assessed. Brain metabolic requirements for young children are much higher than for adults (Scholey *et al.*, 2009). The metabolic processes of adolescents' brains begin to resemble those of adults during puberty and gradually change to reflect adult utilisation profiles until the age of 16 to 18 years. Other than providing a direct fuel source to the brain, glucose ingestion affects acetylcholine, insulin, serotonin, glutamate and cortisol; hormones which may affect cognitive function (Gibson, 2007). It may be a number of central and peripheral changes induced by eating breakfast that influence cognitive function.

2.3.4 Behavioural and psychological importance of breakfast

Aside from the frequency and composition of breakfast intake which influences obesity and disease risk, there are other factors surrounding breakfast intake which could play an influential role. Examples are environmental factors such as the time at which breakfast is eaten, the amount of time taken to consume the breakfast, and the social circumstances under which an individual eats breakfast (Giovannini *et al.*, 2010). It has been suggested that family meals eaten together provide an opportunity for parents to set an example among their children. In this way, parents can influence food choices and behaviour at this meal occasion entrenching behaviours for their children. This further highlights the importance of breakfast among adolescents for both behavioural and physiological reasons (Giovannini *et al.*, 2010; Timlin & Pereira, 2007).

2.3.5 Breakfast, diet quality and nutrient intake

2.3.5.1 Evidence for the relationship

Several international researchers agree that if key nutrients are skipped at breakfast, it was unlikely that individuals will be able to make up those nutrients throughout the rest of the day (Nicklas *et al.*, 1993; Ortega *et al.*, 1998a; Preziosi *et al.*, 1999). This means that the overall quality of the diet can be improved with regular breakfast consumption (Barton *et al.*, 2005;

Kruger *et al.*, 2002). From this it could be derived that the role of breakfast in improving overall diet quality is through the provision of favourable nutrients in a regular morning meal compared to breakfast skippers who would miss this opportunity.

Research has suggested that breakfast skipping influences the remainder of the day's intake through increased risk for skipping meals, increased consumption of snacks or consumption of larger meal portions throughout the day (Dejong *et al.*, 2009; Levin & Kirby, 2012; Nicklas *et al.*, 2000). According to Tin *et al.* (2011), primary school children who skip breakfast are more likely to eat junk foods, consume less fruits and vegetables and drink less milk. This study further showed, that children who skipped breakfast were also more likely to skip lunch (Tin *et al.*, 2011).

A study was conducted among 711 ninth-grade school students in the United States to determine the relationship between breakfast intake and overall diet quality (Nicklas *et al.*, 2000). The study showed that among children who skipped breakfast, the percentage of total daily energy intake was higher from fats and lower from carbohydrates when compared to children who ate breakfast regularly.

Grieger and Cobiac (2012) assessed dietary intakes according to breakfast choice among adolescent Australian boys aged 12 to 16 years. Breakfast was categorised into 3 categories: ready-to-eat cereals (RTEC), non-ready-to-eat cereal (non-RTEC) consumers and breakfast skippers. The study found that boys who consumed RTEC had a higher intake of total sugars, and a lower intake of fat and sodium when compared to non-RTEC consumers, and RTEC consumers had higher intakes of B-vitamins, calcium, iron and magnesium than both non-RTEC consumers and breakfast skippers. According to Affenito *et al.* (2005), research conducted among African-American girls aged 9 to 10 years found that days when breakfast was eaten were associated with higher calcium and fibre intake.

Because a different relationship can be seen between different categories or type of breakfast meals consumed, for example, RTEC vs. non-RTEC, a question is raised as to the effect of different breakfast compositions on overall dietary intake and quality.

2.3.5.2 The effect of breakfast quality on diet quality and nutrient intake

It has been suggested that not only the intake of breakfast, but also the quality of the breakfast consumed, may influence the rest of the day's intake thereby further improving overall diet quality (Nicklas *et al.*, 1998). Aside from the sheer nutrients provided by a breakfast meal, it is plausible to suggest that nutrients consumed at breakfast may affect foods choices and behaviour which follows throughout the rest of the day, predisposing

breakfast eaters to healthier, more nutritious choices when compared to breakfast skippers, who are more likely to display poorer eating habits for the remainder of the day, as measured by a diet quality score (Nicklas *et al.*, 1998).

Stephens and Summar (2008) suggested that the quality or types of foods consumed at breakfast may have an effect on diet quality and food choices for the rest of the day. For example, consumption of wholegrain foods, fruit and low-fat dairy products as well as inclusion of high fibre foods contributes to satiety and an overall healthful diet (Stephens & Summar, 2008). According to Stephens and Summar (2008), eating breakfast which includes these elements may help to reduce total fat intake and limit unfavourable snacking throughout the rest of the day.

Pereira *et al.* (2011) shared the finding of Stephens and Summar (2008). Pereira *et al.* (2011) reviewed two experimental pilot studies which investigated the effects of breakfast frequency and composition on appetite and blood sugar in adults and children. The review concluded that both breakfast frequency and quality may be linked to blood glucose and appetite control. The breakfast composition factors cited as influential were fibre and nutrient rich whole grains and the inclusion of fruit and dairy.

Ortega *et al.* (1998b) conducted a study among 110 Spanish school children to determine the relationship between breakfast consumption and the energy and macronutrient profile of dietary intake for the remainder of the day. The researchers found that among children who consumed breakfasts providing more than 20% of their daily requirements for energy, total daily intakes of energy, proteins, fats and cholesterol were lower than for children consuming breakfasts providing less than 20% of the daily requirement for energy. The study concluded that the quality of breakfast consumed may influence the conditions under which foods choices are made for the remainder of the day. This suggests that energy contribution from breakfast may affect food choices and diet quality.

Several studies have compared the effects of different breakfast categories on diet quality. RTEC is usually a category of its own as this format of breakfast is so commonly consumed as part of Westernised diets worldwide. Breakfast intake, regardless of the type of meal consumed, has been shown to be beneficial for health. RTEC in particular seems to have additional beneficial properties when compared to other breakfast formats. One example of this is in the research conducted by Gibson and Gunn (2011), where RTEC consumers were compared to non-RTEC consumers and breakfast skippers to determine the impact of breakfast intake on diet quality. In general, eating breakfast, regardless of the type, was associated with a lower fat and higher carbohydrate intake over 24 hours when compared

with breakfast skipping. However, RTEC breakfast showed significantly higher intake of micronutrients when compared to non-RTEC and breakfast skippers. This indicates that the properties or composition of an RTEC breakfast may lead to improved intake of certain nutrients, improving overall diet quality. This study showed that an RTEC breakfast had better macronutrient composition in terms of fats, saturates, sugars, carbohydrates and protein when compared to the macronutrient composition of non-RTEC breakfasts (Gibson & Gunn, 2011).

Little research exists on the optimal nutrient profile of breakfast, and further studies and clinical trials are required to develop sound recommendations for implementation in the public health setting (Pereira *et al.*, 2011). Mechanisms for various nutrient profiles of breakfast leading to improved diet quality have been suggested, and these are briefly discussed below.

2.3.5.3 Mechanism of action

Regular breakfast consumption and the quality of breakfast consumed influences diet quality in three ways. The first is through the provision of nutrients at breakfast which would otherwise be missed, and the second is the plausible idea that the quality of breakfast intake may influence food choices and diet quality for the remainder of the day. The third is the idea that individuals who consume a breakfast of high quality will also have good eating habits generally.

Similarly, increasing evidence supports the role of the Glycaemic Index (GI) and protein content when selecting a healthy breakfast, as these factors influence satiety and blood glucose control (Brindal *et al.*, 2012). The carbohydrate, glycaemic index and fibre content of breakfast meals may influence metabolic modifications and physiological changes affecting habitual food choices for the remainder of the day (Giovannini *et al.*, 2010).

The information above suggests that not only the intake of a food or beverage in the morning, but also the composition or quality of the food or beverage consumed, may influence the health benefits associated with regular breakfast intake. Further research is required to better understand the models available for assessing breakfast quality, as well as the effect of different breakfast formats and compositions on subsequent daily intake.

2.4 Measuring breakfast and diet quality

2.4.1 Measuring diet quality

Diet quality is measured using diet quality indices based on food-based dietary guidelines (Gibson, 2005). Reported dietary intake is compared to a number of indices based on

recommendations for consumption of food groups and nutrients (Gibson, 2005; Kourlaba & Panagiotakos, 2009; Patterson *et al.*, 1994). The degree to which the reported intake meets each index recommendation determines the score allocated for each index. The total scores for a number of different indices give an indication of the overall quality of the diet (Gibson, 2005; Kourlaba & Panagiotakos, 2009).

Given the number of interacting variables which play a role in contributing to diet quality, diet quality indices categorise different dimensions of diet quality and provide a means to interpret the variables in one composite, measurable summary (Kourlaba & Panagiotakos, 2009). Kourlaba and Panagiotakos (2009) conducted a review comparing different diet quality indices. The Healthy Eating Index (HEI), Diet Quality Index (DQI), Healthy Diet Indicator (HDI), Mediterranean Diet Scale (MDS) and the Mediterranean Diet Score were among the dietary quality indices reviewed. The diet quality indices reviewed differed in the types of indices included; where some diet quality indices included the use of foods or food groups, others only made reference to intake of individual nutrients (Kourlaba & Panagiotakos, 2009). Only two of the diet quality indices reviewed had adopted a three-pronged approach for measuring diet quality, including markers for dietary pattern in the form of “variety”, as well as for nutrients and food groups. These index measures were the HEI and Diet Quality Index Revised (DQI-R). The DQI was originally developed by Patterson *et al.* (1994) based on US dietary recommendations for nutrients and food groups only. Haines *et al.* (1999) revised and updated the DQI to incorporate current dietary guidance as well as measures for dietary variety and moderation. The updated version of the DQI was called the DQI-R (Kourlaba & Panagiotakos, 2009). According to Kourlaba and Panagiotakos (2009) and Wirt and Collins (2009), the DQI is one of the approaches suggested to quantify dietary patterns and predict disease risk in populations.

The DQI-R consists of 10 components, each with a potential score between 0 and 10. The total score of the DQI-R therefore ranges from 0 to 100 where lower scores reflect poor compliance with dietary guidelines (Kourlaba & Panagiotakos, 2009). The first three components represent macronutrient distribution for total fat, saturated fat and dietary cholesterol. The next three indicators reflect consumption of servings from different food groups: fruits, vegetables and grains. The recommended number of servings is dependent on total energy requirements for a particular population, and the scoring is calculated in accordance with serving recommendations for different ranges of energy requirements. The two indicators which follow reflect adequacy of calcium and iron intake, while the final two components measure dietary variety and moderation (Haines *et al.*, 1999). The 10 nutritional quality indicators and their scoring criteria are summarised by Table 2 below.

Table 2 Components of DQI-R

Component	Score	Scoring criteria
Total fat $\leq 30\%$ energy intake	0-10 points	$\leq 30\% = 10$ $>30, \leq 40\% = 5$ $>40\% = 0$
Saturated fat $\leq 10\%$ energy intake	0-10 points	$\leq 10\% = 10$ $>10, \leq 13\% = 5$ $>13\% = 0$
Dietary cholesterol < 300 mg per day	0-10 points	$\leq 300 = 10$ $>300, \leq 400 = 5$ $>400 = 0$
2-4 servings fruit per day, ^{bc} % recommended servings	0-10 points	≥ 100 99-50% $<50\%$
3-5 servings vegetables per day, ^{bc} % recommended servings	0-10 points	≥ 100 99-50% $<50\%$
6-11 servings grains per day, ^{bc} % recommended servings	0-10 points	≥ 100 99-50% $<50\%$
Calcium intake as a % AI ^d for age ^c % recommended servings	0-10 points	≥ 100 99-50% $<50\%$
Iron intake as a percentage 1989 RDA* for age	0-10 points	≥ 100 99-50% $<50\%$
Dietary diversity score	0-10 points	≥ 6 $\geq 3, <6$ <3
Dietary moderation score	0-10 points	≥ 7 $\geq 4, <7$ <4

^b Based on 1600, 2200 or 2800 kcal diet

^c Used as a continuous variable

^d AI = adequate intake value

* RDA = recommended dietary allowance

A dietary diversity score is measured by assessing the number of food group categories reflected in a day's consumption. Twenty-three food group categories were selected to represent dietary diversity including seven categories of grains, seven categories of vegetables, two categories of fruits and seven groups of animal based products like meat, fish or dairy products (Haines *et al.*, 1999). Table 3 shows the elements of the dietary diversity score.

Table 3 Elements of the dietary diversity score

Food group	Food subgroup	Representative foods
Grains	Non-whole grain breads	White bread, plain bagels
	Quick breads	Muffins, corn bread, biscuits, pancakes
	Pasta	All pasta dishes
	Whole grain breads	Breads, rolls, crackers, pita breads, bagels, tortillas, pizza
	Whole grain cereals	Cooked and ready to eat cereals
	Rice	All rice dishes
	Non-whole grain cereals	Cooked and ready to eat cereals
Vegetable components	Other vegetables	Raw and cooked, salads, green beans
	White potatoes	Mashed and fried potatoes, French fries
	Tomato products	Fresh, sauces, juice
	Other starchy vegetables	Lima beans, corn
	Dry peas and beans	Lentils, kidney beans, soy products
	Deep yellow and Orange vegetables	Winter squash, carrots, sweet potatoes
	Dark green and leafy vegetables	Spinach, broccoli
Fruit components	All other fruit	Apples, bananas, grapes, raisins
	Citrus fruit, melons, berries	Oranges, citrus juices
Meat components	Beef, pork, organ meats, lunch meats	Ground beef, ham
	Milk	Milk, buttermilk
	Poultry	Chicken, turkey
	Cheese	Natural and processed cheese
	Eggs	Egg dishes, sandwiches, soups
	Fish	Canned tuna, shellfish, finfish
	Yoghurt	Refrigerated and frozen yoghurt

The dietary moderation score is based on consumption of added sugars, discretionary fat, and sodium and alcohol intake (Haines *et al.*, 1999). These elements, as well as their applicable score criteria, are summarised in Table 4 below.

Table 4 Elements of diet moderation score

Component	Score	Scoring criteria
Teaspoons added sugar ^b	0-2.5 points	100% or less of maximum = 2.5 points >100%, ≤150% = 1.5 points >150%, ≤200% = 1.0 point >200% = 0 points
Discretionary fat (g)	0-2.5 points	≤25 g/day = 2.5 points >25, ≤50 = 1.5 points >50, ≤75 = 1.0 point >75 = 0 points
Sodium intake (mg)	0-2.5 points	≤2400 mg = 2.5 points

Component	Score	Scoring criteria
		>2400 ≤3400 = 1.5 points >3400 = 0 points
Alcohol intake ^c	0-2.5 points	100% or less = 2.5 points >100%, ≤150% = 1.5 points >150%, ≤200% = 1.0 point >200% = 0 points

^b Based on 1600, 2200 or 2800 kcal diet

^c Recommendation for alcohol intake = 1 drink per day for women and 2 drinks per day for men

Using the indices and score criteria summarised above, the DQI-R captures overall diet quality in terms of food groups, nutrients and dietary behaviour patterns in the form of dietary diversity and moderation.

2.4.2 Measuring breakfast quality

Poor breakfast quality has been defined as lower consumption of core food groups at breakfast time (Lytle *et al.*, 2000), although to date, no universal criteria have been developed to measure breakfast quality. Studies measuring breakfast quality in the past developed criteria on an individual basis specific to the objectives of the research (O'Sullivan *et al.*, 2009; van den Boom *et al.*, 2006). Developing a universal breakfast quality scoring tool would be useful for the comparison of breakfast quality in different population groups and different countries. Such a tool would also help to shape guidelines for recommendations for how to build a high quality breakfast. However, diet quality indices for breakfast and the overall diet should be consistent with the national food-based dietary guidelines for each country, and developing one set of guidelines to satisfy the requirements of different countries may not be feasible.

Radcliffe *et al.* (2004) described breakfast quality by allocating a breakfast quality score. The scoring system was based on the five core food groups as defined by the Australian Guide to Healthy Eating (AGHE) listed as:

- breads and cereals (including breakfast cereals, bread and rice);
- vegetables;
- fruit;
- dairy products (including soya milk products);
- meat and meat alternatives (including eggs, vegetarian meat alternatives and nuts).

This model allocated an additional group called “extras” for all foods and beverages not classified into one of the core food groups outlined above. This was based on the assumption that although “extra” foods may contain some nutrients, they may not be considered good sources of the essential nutrients. “Extra” foods include items high in sugar and/or saturated fat such as soft drinks, biscuits, cake, pancakes and chocolate bars, as well as high-fat savoury goods such as pastries and sausage rolls. Table 5 below outlines the breakfast quality score allocation as described by Radcliffe *et al.* (2004).

Table 5 Scoring system used to assess breakfast quality

Score	Definition
1	No food or beverage (other than water); breakfast skipping
2	A food or beverage from “extra” foods only
3	A food or beverage from one AGHE group
4	A food or beverage from two AGHE groups
5	A food or beverage from three or more AGHE groups

AGHE: Australian Guide to Healthy Eating

Where an “extra” food is consumed in addition to one or more foods or beverages from an AGHE group, “extras” will not contribute to the final breakfast quality score.

By applying this model, the breakfast quality score ranges from 1 to 5 points depending on the breakfast consumed.

The South African Food-Based Dietary Guidelines (FBDGs) have identified core food groups recommended for intake in South Africa as (Vorster *et al.*, 2013):

- starchy foods
- vegetables and fruit
- dry beans, split peas, lentils and soya
- milk, maas or yoghurt
- fish, chicken, lean meat or eggs

Although named slightly differently, the core food groups as described by the AGHE and the South African FBDGs incorporate the same types of foods. For this reason, the breakfast

quality score as applied by Radcliffe *et al.* (2004) would also be of relevance in the South African context.

2.5 Trends in breakfast intake among adolescents

2.5.1 The prevalence of breakfast intake among adolescents globally

Research conducted among adolescents globally has provided an indication of the prevalence of breakfast intake and skipping in a number of countries. Table 6 below provides a summary of breakfast intake prevalence data for different countries as reported by 25 different studies.

Table 6 Summary of breakfast intake prevalence among adolescents globally

Reference	Country	Sample group	Result
Feeley <i>et al.</i> (2012)	South Africa	1451 students aged 13, 15 and 17 years	The prevalence of breakfast skipping for each age group was 24%, 36% and 35% respectively
Temple <i>et al.</i> (2006)	South Africa	476 students in grades 7 to 10	22% of students did not have breakfast before going to school
Kruger <i>et al.</i> (2002)	South Africa	Review of 4 studies assessing breakfast intake among South African children (total of 1557 children aged 6 to 14 years)	14 to 19% of children went to school without eating breakfast
Walker <i>et al.</i> (1982)	South Africa	4717 rural Black, urban Black, Indian, African-Malay and White pupils aged 16 to 18 years	21% of rural Black, 19% of urban Black, 13% of Indian, 13% of African-Malay and 14% of White adolescents skipped breakfast
Jaaskelainen <i>et al.</i> (2012)	Finland (Europe)	6247 adolescents aged 16 years	16% of the boys and 24% of the girls reported regular breakfast skipping
Veltsista <i>et al.</i> (2010)	Finland and Greece (Europe)	3452 Greek adolescents aged 17 to 18 years; 7128 Finnish adolescents average age of 16	74.7% of Finnish boys, 61.6% of Finnish girls, 48.8% of Greek boys and 44.1% of Greek girls reported eating breakfast daily
Dialektakou and Vranas (2008)	Greece (Europe)	811 adolescents aged 15 to 21 years (mean age 16.62)	74.7% of the participants reported eating breakfast at most, 6 times per week, and 3.6% never ate breakfast
Gomez-Martinez <i>et al.</i> (2012)	Spain (Europe)	2859 adolescents from 5 Spanish cities aged 13 to 18.5 years	11% of participants reported they had not had breakfast on the day of the survey

Reference	Country	Sample group	Result
Hallstrom <i>et al.</i> (2011)	10 European cities	3000 adolescents aged 13 to 17 years	54% of the adolescents were regular breakfast consumers; 38% of adolescents agreed that they often skipped breakfast
de Moraes <i>et al.</i> (2012)	Brazil	991 students from high schools	37.8% of males and 34.6% of females skipped breakfast on the day of the survey
Estima <i>et al.</i> (2009)	Brazil	528 adolescents aged 12 to 18 years	Omission of breakfast was observed in 4.5% of the boys and 12.4% of the girls
Deshmukh-Taskar <i>et al.</i> (2010)	US	5339 adolescents, age 14 to 18	31.5% of adolescents were breakfast skippers
Merten <i>et al.</i> (2009)	US	7788 adolescents aged 11 to 16 years	41.3% of adolescents reported irregular breakfast consumption (less than 4 days per week)
Roseman <i>et al.</i> (2007)	Kentucky (US)	4049 middle school students	35% of the participants reported regular breakfast skipping (consuming breakfast for 0 to 3 days over the previous week)
Delva <i>et al.</i> (2006)	US	35107 12 th grade students	66.2% of White, 79.7% of Black and 77.7% of Hispanic students reported eating breakfast infrequently
Niemeier <i>et al.</i> (2006)	US	14738 adolescents aged 11 to 21 years	On average, breakfast was consumed on 4.34 days per week
Affenito <i>et al.</i> (2005)	US	2379 African-American and White girls aged 9 to 19 years	At age 13, 53% of White girls and 35 % of African-American girls had eaten breakfast on all three days of data collection. At age 19, 32% of White girls and 22% of African-American girls had eaten breakfast on all three days of data collection
Nicklas <i>et al.</i> (2000)	US	711 15-year old ninth-grade	19% breakfast skipping prevalence for 15-year old school

Reference	Country	Sample group	Result
		students attending high schools	children
Woodruff <i>et al.</i> (2008)	Canada	1826 adolescents in grades 9 and 10	27% of participants reported breakfast skipping
Stockman <i>et al.</i> (2005)	Canada	180 adolescent males aged 14 to 18 years	26% of participants were classified as inconsistent breakfast consumers
Sandercock <i>et al.</i> (2010)	UK	4326 school children aged 10-16 years	25% sometimes skipped breakfast; 7% always skipped breakfast
Lattimore and Halford (2003)	UK	1019 school children aged 11 -16 attending secondary schools	19% of children skipped breakfast on the day of the survey
Yeung (2010)	Hong Kong	836 adolescents, age 11 to 18	54% of the participants did not eat breakfast every day
Maddah (2008)	Iran	2090 Iranian high schools girls from urban and rural areas	Breakfast skipping was reported by 53% of normal weight urban girls, 63.7 % of overweight urban girls, 47.9% of normal weight rural girls and 65.7% of overweight rural girls
Shaw (1998)	Australia	699 13 year old adolescents	12% of the sample skipped breakfast

The prevalence of infrequent breakfast intake and breakfast skipping ranges from as high as 79.7% among Black students in the US as reported by Delva *et al.* (2006) to 7% of adolescents always skipping breakfast in the UK as reported by Sandercock *et al.* (2010).

2.5.2 Breakfast intake among South African adolescents

Little research has been conducted to assess the dietary intake of adolescents in developing countries, such as South Africa (Temple *et al.*, 2006; Walker *et al.*, 1982). In South Africa, research reporting breakfast behaviour among adolescents is also limited. A literature search spanning from 1982 to 2013 on Science Direct, Pubmed and Ebscohost databases yielded only five studies and one review article which address breakfast intake among adolescents and children in South Africa. The first study assessed the breakfast habits of adolescents in four South African populations and was carried out by Walker *et al.* (1982). The study found the prevalence of breakfast skipping to be 21% among rural Black, 19% in urban Black, 13% in Indian, 13% in African-Malay and 14% in White pupils aged 16 to 18 years. The main reason cited for breakfast skipping, was lack of time to eat breakfast before school. This study found no significant impact of breakfast behaviour on weight, height, classroom behaviour or frequency of absence from school. The study concluded that the relationship between nutrition, breakfast, health and academic performance required more research in the form of prospective studies.

Following this, a review article assessing the importance of breakfast in meeting the nutritional requirements of South African children was published by Kruger *et al.* (2002). The review summarised the findings of four studies which were conducted in South Africa, as well as several other studies conducted around the world. The research conducted by Walker *et al.* (1982) was one of the four South African studies reviewed. The remaining three studies, were conducted among children aged 6 to 14 years, and were not reflective of an adolescent population. However, trends in breakfast intake observed in South African children pre-adolescence may still provide some context to the breakfast-intake environment among South Africans still attending school. The review found that 14 to 19% of children in South Africa went to school without eating breakfast. The review article concluded that breakfast intake is important in helping schoolchildren to meet their nutritional requirements and that breakfast omission has been associated with adverse nutritional consequences.

The second study conducted by Temple *et al.* (2006), sought to investigate the food consumption patterns of adolescents attending 14 secondary schools in Cape Town. A total of 476 students were included in the study. It was found that 22% of the study participants

did not have breakfast before going to school. The study highlighted the need for adequate and effective school nutrition programmes, given that a large number of students were not eating breakfast at home, further highlighting the importance of a nutritious meal at school. The authors concluded by recommending national policies to improve the quality and types of foods made available for purchase in secondary schools, as well as highlighting the need to educate parents on nutrition and dietary requirements for their children.

The third study conducted by Stupar *et al.* (2012) was qualitative in nature. Through several focus groups with 25 female learners aged 14 to 16 years in grade 10, the study sought to understand how the nutrition transition and other factors influence the food choices of adolescents in South Africa. The study participants reported that although they understood the importance of breakfast in sustaining health and energy in young people, lack of time in the morning caused them to skip breakfast frequently. The girls also acknowledged that if their families sat together to eat breakfast in the mornings, they would be less likely to skip this meal.

Feeley *et al.* (2012) published breakfast intake data from the Birth to Twenty cohort study conducted among adolescents living in urban South Africa to assess their dietary habits and eating practises. The study compared dietary behaviour between 1451 adolescents aged 13, 15 and 17 years. The study found that regular breakfast intake of at least three times per week only occurred in 76% of 13 year olds, 64% of 15 year olds and 65% of 17 year olds. This indicated the prevalence of breakfast skipping for each age group to be 24%, 36% and 35% respectively. Furthermore, the study found that 15 year olds and 17 year olds were significantly more likely to skip breakfast than adolescents aged 13 years. This indicates that regular breakfast intake decreased with age. Male participants were shown to consume breakfast more frequently than female participants, and while regular weekend breakfast consumption was higher than breakfast consumption on weekdays, weekend breakfast consumption was still seen to decline with age. The study concluded that dietary patterns were well established by 13 years of age.

Lastly, the most recently published study which included interest in the breakfast habits of children aged 10 to 14 years was the South African National Health and Nutrition Examination Survey (SANHANES) (Shisana *et al.*, 2013). The SANHANES reported that more than two-thirds (68.4%) of children aged 10 to 14 years indicated that they eat breakfast before going to school, while 19% had indicated that they did not eat breakfast before going to school. The remainder was not discussed in the report. The study further showed that the majority of children believed that it was important to eat breakfast before

going to school because it helped them to concentrate better (86.1%) and gave them energy for the day (89.3%) (Shisana *et al.*, 2013). Given that nutritional knowledge with regards to the benefits of breakfast is in place among South African children, the need to investigate the reason for the high prevalence of breakfast skipping is paramount.

By province, children in the Western and Eastern Cape were significantly more likely to eat breakfast than children in the Northwest, Gauteng and Limpopo provinces. The prevalence of reported breakfast intake by province is shown in Figure 4 below.

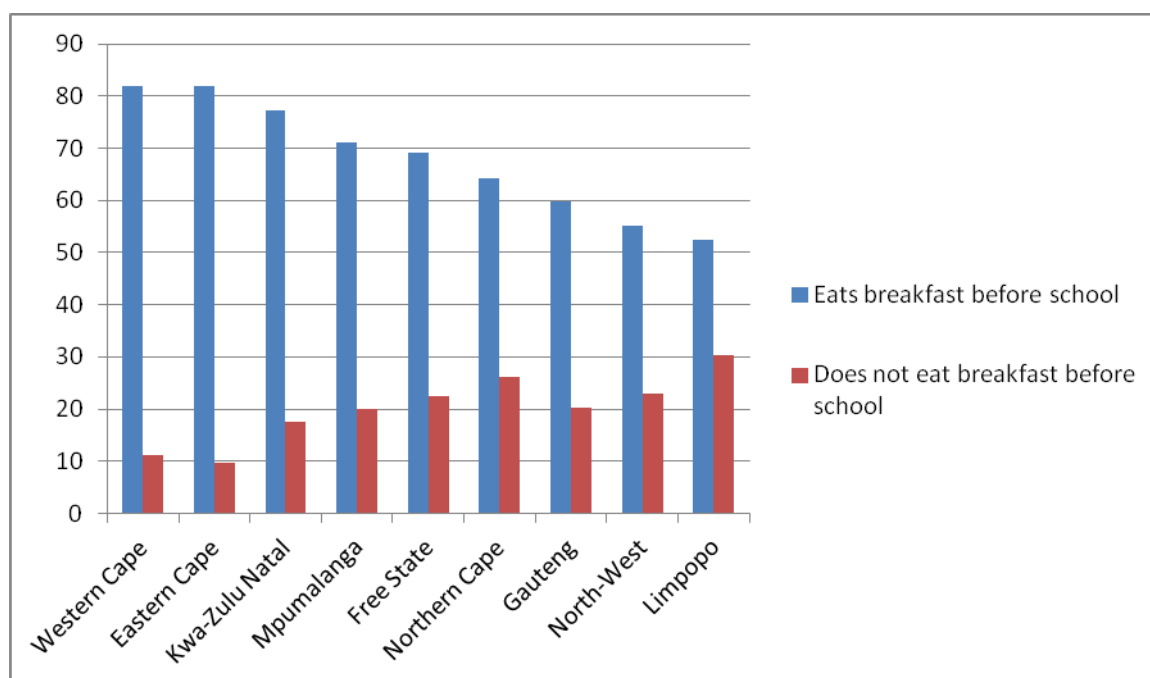


Figure 4 Prevalence of breakfast intake and skipping by province adapted from (Shisana *et al.*, 2013)

Children in the Northwest and Limpopo were significantly less likely to believe that breakfast helped them to concentrate when compared to children in the Eastern Cape. Children in Gauteng and the Northwest were least likely to believe that breakfast helped to provide energy for the day when compared to children in the Eastern Cape. There were no significant differences by sex or locality (urban/rural, informal/formal settings). There were no significant racial differences between the prevalence of breakfast intake for different racial groups, however among white children, there were too few observations to record reliably (Shisana *et al.*, 2013).

The SANHANES further reported on the reasons indicated for skipping breakfast. The first was “not being hungry in the morning” (39.2%) followed by “not having enough food in the house” (33.9%), then “people at home do not have breakfast” (33%), “cannot get up early

enough” (19.2%) and “cannot make your own breakfast” (15.3%) (Shisana *et al.*, 2013). Aside from ‘not having enough food in the house’ indicating a food security issue, most of the reason cited for breakfast skipping are environmental or behavioural issues. The most frequent reasons reported for breakfast skipping by locality are shown in Figure 5 below.

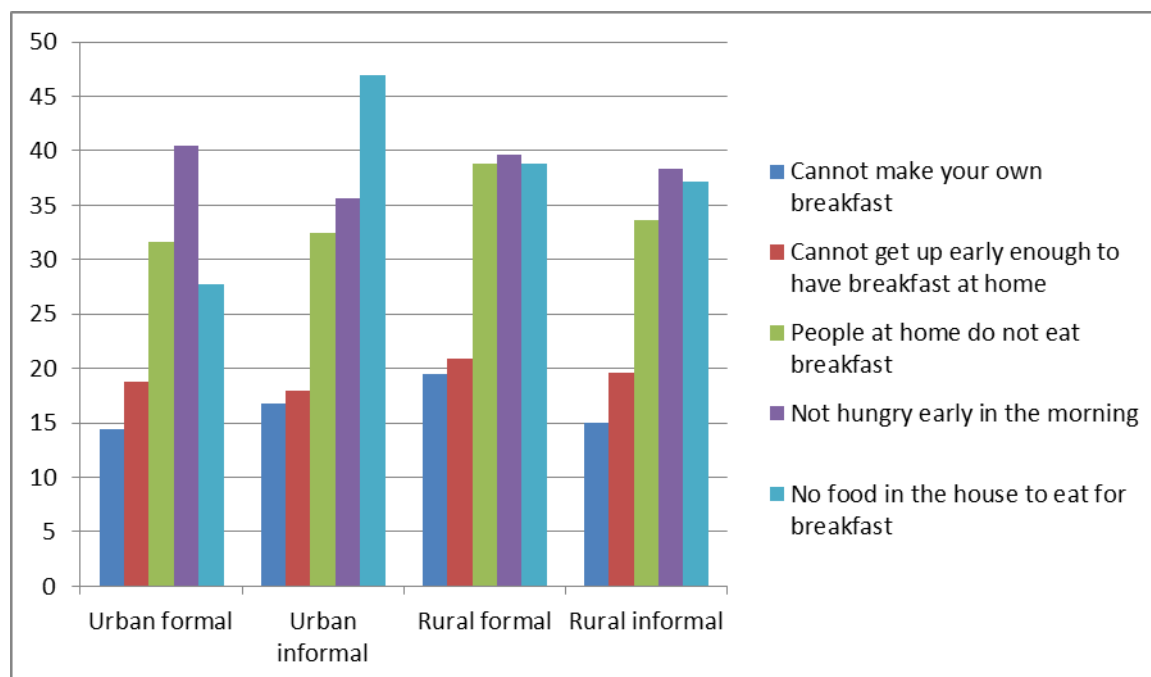


Figure 5 Reasons for breakfast skipping by locality ~ adapted from Shisana *et al.* (2013)

There was a significant difference between urban informal children and urban formal children regarding ‘no food in the house to eat for breakfast’. There is an increased likelihood for food insecurity in the urban informal setting, affecting breakfast intake among these children.

Understanding the factors which influence breakfast behaviour will help the development of effective and relevant strategies and guidelines for improving breakfast intake among adolescents.

2.6 Factors influencing breakfast intake among adolescents

2.6.1 Conceptual framework of factors influencing breakfast behaviour

The individual and environmental influences which adolescents are exposed to during the critical phase of transition from childhood to adulthood can affect food choices and dietary behaviour (Pearson *et al.*, 2009). By understanding the factors underlying breakfast

skipping behaviour, more effective and relevant strategies to improve the behaviour can be implemented (de Moraes *et al.*, 2012; Story *et al.*, 2002). However, there are many dynamic and interlinked factors which influences adolescents eating behaviour, and none can be seen as predictive of behaviour in insolation (Stevenson *et al.*, 2007).

Story and co-workers endeavoured to create a conceptual framework describing the various factors influencing breakfast behaviour (Story *et al.*, 2002). Conceptual models are commonly used for understanding and explaining the dynamics of health behaviour (Glanz & Rimer, 1995). Two models were considered in the development of this framework. The first was Social Cognitive Theory which focusses on the role of personal, environmental and behavioural factors in guiding health behaviour (Baranowski *et al.*, 1997). The second was an ecological model, which focuses on interactions between people and their environments (McLeroy *et al.*, 1988). Taking these two models into account, Story *et al.* (2002) noted that the factors influencing breakfast behaviour can be summarised into four broad categories: individual or intrapersonal influences, social-environmental or interpersonal influences, physical environmental or community settings and lastly, macro-system or societal influences. Figure 6 below shows the matrix of interacting factors which influence breakfast behaviour.

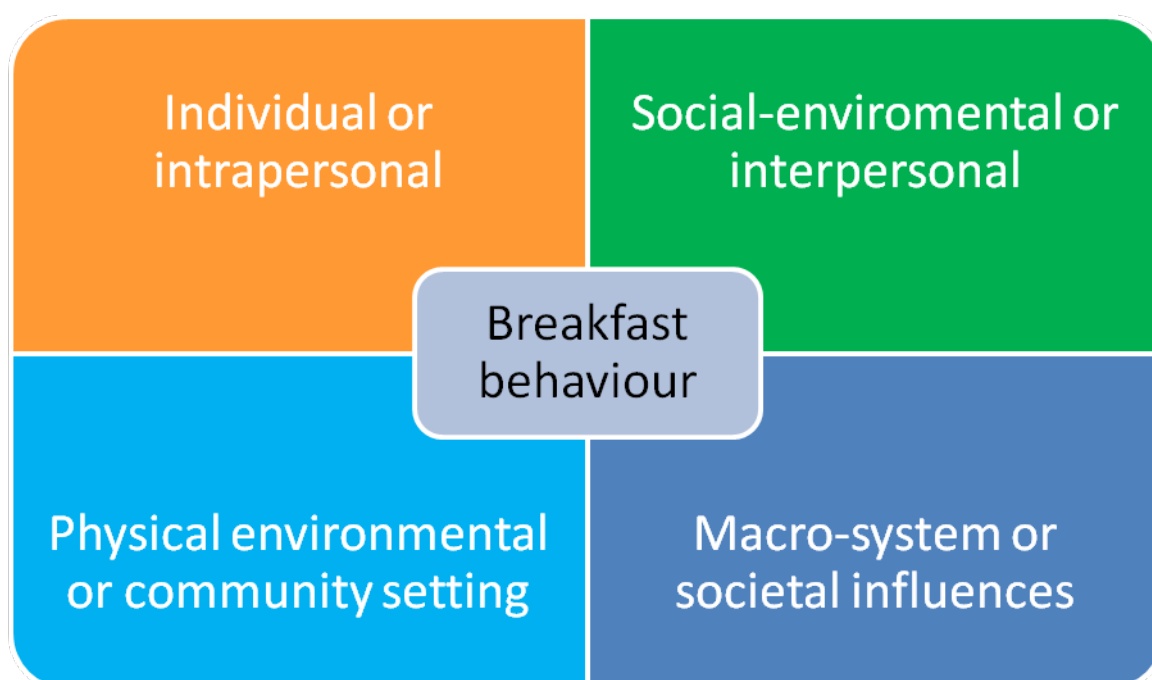


Figure 6 Factors influencing breakfast behaviour ~ adapted from Story *et al.* (2002)

2.6.1.1 Individual or intrapersonal factors

Individual influences are individual characteristics which influence eating behaviour. Examples include age, gender, food preferences, attitudes and beliefs towards foods, knowledge regarding nutrition and foods, as well as biological factors such as hunger. Meal frequency, snacking habits and perceived barriers to healthy eating (such as time available, convenience and cost) are also individual influences (Story *et al.*, 2002).

2.6.1.1.1 Age

Frequency of breakfast intake has been seen to decline with age during adolescence (Affenito *et al.*, 2005; Delva *et al.*, 2006). Delva *et al.* (2006) and his team investigated ethnic and sociodemographic differences in overweight adolescents to determine the relationship between the variables and predicting health-related behaviours among American students. Delva *et al.* (2006) observed that substantially fewer White, Black and Hispanic youth had frequent breakfast intake in grade twelve when compared to the frequency of breakfast intake among students in grade eight.

Affenito *et al.* (2005) conducted a study to measure breakfast consumption among African-American and White adolescent girls in the US. To determine frequency of breakfast consumption, dietary intake over three days was assessed, and intake was considered frequent if the participants consumed breakfast on all three days of assessment. Among study participants aged 9 years, 77% of White girls and 57% of African-American girls ate breakfast frequently. Among study participants aged 19 years, only 32% and 22% of White and African-American girls reported frequent breakfast consumption. The study concluded that the number of days breakfast was eaten tended to decrease with increasing age, and this finding was significant ($P < 0.0001$).

Levin and Kirby (2012) used data from the Scottish Health behaviour in School-aged Children surveys conducted in 2002, 2006 and 2010 to determine which factors within the family environment influenced irregular breakfast consumption. Regardless of family structure, being of older age or of higher grade was significantly associated with irregular breakfast consumption for adolescents.

According to research conducted by Hallstrom *et al.* (2011), younger adolescents are more likely to be influenced by their parents' food choices and breakfast behaviour. This trend tends to decrease as the adolescent's age increases. This may be as a result of older adolescents expressing their independence and autonomy, and choosing not to follow their parents' example (Hallstrom *et al.*, 2011).

2.6.1.1.2 Gender

Hallstrom *et al.* (2011) assessed the factors affecting food choices and breakfast habits among European adolescents, it was found that overall, girls were less likely to be regular breakfast consumers when compared to boys ($p < 0.05$). These findings were supported in the research conducted by (Merten *et al.*, 2009), which also concluded that females were less likely than males to eat breakfast during adolescence. An Australian based study investigating adolescent breakfast skipping identified gender to be the only statistically significant demographic variable predicting breakfast skipping behaviour ($p < 0.00001$) (Shaw, 1998).

These findings contradict understanding of female dietary behaviour as females typically make more healthy food choices and have a greater concern for health than males (Hallstrom *et al.*, 2011; Lattimore & Halford, 2003). A possible explanation for this observation is that because females are typically more health conscious and are more likely to adopt energy-restrictive dieting techniques, they are significantly more likely to skip breakfast (Lattimore & Halford, 2003).

Yeung (2010) conducted a study among adolescents age 11 to 18 years in Hong Kong to understand different gender perspectives on adolescent eating behaviours. While the study found no significant difference in the likelihood of breakfast intake between male and female students, it did find that females were more likely to be weight conscious, in line with the findings of Lattimore and Halford (2003).

2.6.1.1.3 Food preferences, taste and hunger

Self-reported food preferences have been found to be one of the strongest predictors of food choices, especially among adolescents. Food preferences are formed through a series of interactions throughout an individual's life, such as exposure, experience associated with certain foods and individual genetic palate, ultimately conditioning individuals to their food preferences (Story *et al.*, 2002).

According to the research conducted by Hallstrom *et al.* (2011), the personal factors of 'hunger' and 'taste' were some of the most important influences of food choice at breakfast among adolescents. Similar findings were reported by Yeung (2010), indicating that 'flavour' was a key factor in driving food choice. Yeung (2010) also reported that cost was a main concern when making food choices, but nutritive value and hygiene were less important influences among these adolescents.

In 12 focus group discussions conducted by Stevenson *et al.* (2007) among adolescents based in the UK, it was found that food aesthetics, such as taste, texture, appearance and smell were the most powerful reinforcers of food choice. As a result, foods which were less healthy, but offered good taste were viewed as rewarding because of the foods physical properties, where healthier foods (notably green vegetables) were noted to be bland or unpleasant.

Berg *et al.* (2003) conducted a study among Swedish adolescents aged 11 to 15 years to determine the reasons for choosing different fat and fibre-containing foods at breakfast. While students were aware of which cereal products were higher in fibre, and aware of the associated health benefits of fibre, the study participants were less likely to choose these foods for usual breakfast consumption. The reason for this was that in general, the students perceived foods higher in fibre to be less palatable. In this example, the taste of the food was the key factor in determining which food would be consumed at breakfast regardless of the nutrition credentials of the food (Berg *et al.*, 2003).

Because the 'tastiest' foods are often those higher in fats, sugars and energy, allowing 'taste' to be the key driving factor for food choices may compromise nutrition intake. French *et al.* (1999) assessed motivational forces for selecting different foods from a vending machine among adolescents. Adolescents who rated 'taste' as the most important factor in snack choice had a significantly lower intention to choose lower fat snack options from the vending machine (French *et al.* (1999) cited by Story *et al.* (2002)).

Addressing attitude and food beliefs may be more important than knowledge in altering food-related health behaviour (Nowak & Buttner, 2003).

2.6.1.1.4 Attitudes, beliefs and nutritional knowledge

MacNicol *et al.* (2003) assessed the relationship between attitudes and dietary behaviour among Scottish adolescents aged 11 to 15 years. The study found that children who were better-informed or had a higher level of knowledge with regard to food, nutrients and diet had better dietary habits, and a more positive attitude to foods (MacNicol *et al.*, 2003). However, it has been noted that knowledge about nutrition and food risks often does not translate into more healthy eating behaviour (Stevenson *et al.*, 2007). When assessing the knowledge of adolescents with regard to healthy eating, in general adolescents understand the theoretical guidelines and messages, however despite this, adolescents find it difficult to practically apply theoretical healthy eating guidelines (Stevenson *et al.*, 2007; Yeung, 2010). This is likely as nutritional knowledge may not be the central motivation for food choice among

adolescents. In South Africa, there is little published data on the nutrition knowledge of adolescents, and their impact on food-related behaviour (Steyn, 2010).

The Theory of Planned Behaviour (TPB) is a widely used theoretical model which predicts behaviour, based on an individual's intention (Ajzen, 1991). Intention is driven by three key factors: attitude, subjective norm and perceived behavioural control. One weakness of this model is that although it may be effective in predicting individual intention, it cannot predict whether that intention will actually translate into behaviour (Ajzen, 1991). Nonetheless, the TPB has been used to explain behaviour and trends with regard to smoking, exercise, fruit and vegetable consumption and soft drink consumption. It has also been suggested that the TPB provides a better model of breakfast consumption than other models which exist (Kothe *et al.*, 2011; Mullan *et al.*, 2013).

Dejong *et al.* (2009) sought to identify the cognitive and environmental correlates of breakfast consumption among adolescents in the Netherlands. Individual cognitions defined by the TPB namely intention to perform a behaviour, attitude towards a behaviour, perceived control over the behaviour and social norms surrounding the behaviour were assessed. The study found that individual factors attitude, intention and decision for self were associated with daily breakfast consumption.

The SANHANES reported that children in the Northwest Province are less likely to believe in the benefits of breakfast, namely 'helping you to concentrate' and 'provides you with energy for the day' when compared to children in the Eastern Cape (Shisana *et al.*, 2013). Because these children are less likely to perceive breakfast intake to be beneficial, they are also less likely to prioritise regular breakfast intake. This could be one of the factors driving the observation that 81.9% of children in the Eastern Cape reported eating breakfast every day, compared to only 55.1% in the Northwest Province.

2.6.1.2 Social-environmental or interpersonal factors

Social environmental influences, such as family, friends, peer networks and demographic characteristics, can influence food behaviour, especially among adolescents (Story *et al.*, 2002). These factors highlight the mechanisms of modelling, reinforcement, social support and perceived norms in guiding eating behaviour.

2.6.1.2.1 Socio-economic status

The Health-Related Behaviours among American students: National Trends Report conducted in the US sought to establish long term trends in race and socio-economic status (SES) relating to students who are overweight and engaging in health behaviours associated

with weight loss (Delva *et al.*, 2006). The study showed a consistent positive association between SES and regular breakfast consumption. Students of high SES were significantly more likely to consume breakfast than students of low SES.

Breuning *et al.* (2011) found similar results; in a study aiming to identify the predictors of breakfast consumption among adolescents in the US, based on the findings of the Project 'Eating Among Teens' (EAT). One finding of this study was that study participants from higher SES were more likely to report regular breakfast consumption. Breuning *et al.* (2011) noted that interventions promoting breakfast consumption in lower income schools are required.

Merten *et al.* (2009) analysed data from the National Longitudinal Study of Adolescent Health in the US to understand the interaction between breakfast, obesity and community and family influences. According to (Merten *et al.*, 2009), higher levels of community disadvantage and family poverty decreased the likelihood of adolescent breakfast consumption.

A number of factors linked to lower SES could influence decreased breakfast consumption, such as limited access to food outlets, limited shared family time, strained financial resources, food insecurity and lack of nutrition and health knowledge (Gable & Lutz, 2000).

Contrary to these findings, (Hallstrom *et al.*, 2011) found that adolescent males who perceived their family to be "not well off" were more likely to consume breakfast regularly when compared to adolescent males who perceived their family to be "well off".

Pearson *et al.* (2009) conducted a systematic review of correlates of breakfast consumption among adolescents. Of the 13 studies included which investigated adolescent breakfast consumption, seven found that socio-economic status was positively associated with breakfast consumption. The remaining six study samples reviewed found no association between these variables. While studies have shown the inverse relationship between SES and breakfast consumption among adolescents, others have argued that the influence of peers, schools and the environment outweigh the influence of SES on breakfast intake (Pearson *et al.*, 2009).

2.6.1.2.2 Influence of friends and peers

The influence of peers and conformity to acceptable norms within a peer group is typical of adolescent behaviour (Story *et al.*, 2002). Adolescents spend a significant amount of time with their friends, and eating is a form of socialisation and recreation. Adolescent peers help to create the norms concerning acceptable behaviour, including dietary behaviour.

Dejong *et al.* (2009) identified 'modelling by friends' as an environmental correlate of adolescent breakfast consumption. Study participants were asked to rate the question, "How often do your friends eat breakfast" as always (+2) or never (-2). Participants who reported a higher score for "How often your friends eat breakfast" were more likely to eat breakfast regularly themselves. This indicates that behaviour which is deemed acceptable among a peer group, in this case eating breakfast, will influence individuals within that group to conform to this behaviour.

Breuning *et al.* (2012) examined the associations of healthy eating between adolescents and their friends looking specifically at breakfast, fruit, vegetable, wholegrain and dairy intake. Data for the study was drawn from Project EAT. The study found significant positive associations between adolescents and their friends for breakfast eating, wholegrain intake and dairy intake. The study findings suggested that adolescent friends exhibit similarities in dietary intake (Breuning *et al.*, 2012).

Research regarding the role of peer influence on dietary behaviour is sparse. One reason for this may be that social influences are difficult to measure (Feunekes *et al.*, 1998; Story *et al.*, 2002). In the case of adolescents who are becoming independent and expressing their autonomy, admitting their behaviour is influenced by their peers is unlikely. Furthermore, adolescents may not be aware of the impact of social eating norms on their behaviours. Further research is required on this topic to understand the role of peer pressure on dietary behaviour, particularly breakfast behaviour.

2.6.1.2.3 Parental modelling and family structure

Families mediate dietary behaviours for adolescents in two ways: first is the provision of certain foods affecting availability and accessibility of foods to the adolescent, and second is the role of the family and parents in particular in influencing food preferences, values, attitudes and habits (Story *et al.*, 2002).

While parents have little influence on adolescent food choices outside of the home, they can influence which foods are available within the home. Ensuring that nutritious healthy foods are available and visible guides the adolescent's food choices (Story *et al.*, 2002).

Levin and Kirby (2012) investigated irregular breakfast consumption by family structure, and breakfast intake was shown to vary depending on the family dynamics present. Difficult parent-child relationships or poor communication and irregular personal and family routines were associated with irregular breakfast intake regardless of the number of parents in a household. In households where both parents were present, living with siblings, being

treated unfairly and having older siblings was associated with irregular breakfast consumption. Being close to at least one parent was associated with reduced likelihood of irregular breakfast consumption in single mother households, and in single mother homes, adolescents with mothers who worked away from home also had higher likelihood for irregular breakfast intake (Levin & Kirby, 2012). Similarly, Merten *et al.* (2009) found that adolescents who had at least one parent present in the morning were more likely to eat breakfast than adolescents who had no parents present in the morning.

Family routines are important to facilitate communication and connections between family members, as well as to promote family identity and organisation. Opportunities for connecting with family members allows parents to socialise with young people, share values and experiences, and influence their children's habits and activities. Family organisation and routine have been linked to adolescent psychological health, body weight status and dietary intake. Routines and socialisation in turn impact parent-child relationships (Levin & Kirby, 2012).

Hallstrom *et al.* (2011) highlighted the role of parents in encouraging healthy eating behaviour among adolescents. In this study, boys from single-parent/divorced families were less likely to eat breakfast regularly when compared to boys from traditional families. Boys whose parents gave little or no encouragement to eat breakfast or follow a healthy diet tended to be less likely to eat breakfast regularly. Where parents of boys practised healthy eating behaviours themselves, their sons were more likely to eat breakfast regularly when compared to boys whose parents did not practise healthy eating behaviours.

From the information above, it appears that parents have a key role to play in guiding food behaviours among their children. By setting a positive example of dietary intake behaviours themselves, they create a standard of acceptable dietary behaviour, which their children are more likely to comply with. It has been suggested that increased frequency of meal eaten together as a family is an effective way of influencing adolescent's breakfast habits and to create an environment that encourages general health conscious behaviour (Hallstrom *et al.*, 2011; Levin & Kirby, 2012).

2.6.1.3 Physical environmental or community setting

The physical environment in which a community exists affects accessibility and availability of different foods (Story *et al.*, 2002).

As young adolescents become young adults, their likelihood for eating more meals out of the home increases. It has been reported that a third of adolescent eating occasions take place

outside of the home, and is comprised of meals at school, fast food restaurants, vending machines and other locations (Anon, 1998). For this reason, the physical environment to which an adolescent is exposed significantly impacts the type of foods made available to them, thus influencing dietary intake, meal frequency and patterns.

2.6.1.3.1 School

The school food environment may have a key influence on adolescents' dietary behaviour and food choices because a large portion of adolescents total daily energy intake is consumed at school (Burghardt *et al.*, 1993).

Temple *et al.* (2006) investigated foods items consumed by students attending different schools in Cape Town. While 22% of the study participants skipped breakfast before going to school, 80% did eat a meal at school, which in the majority of the cases was purchased from the school. Three quarters of the food purchased at the school came from a tuck shop and was generally regarded as less-healthy food. One quarter of the students who bought food from school purchased from local vendors. In this case, the types of food to which children are exposed at school influence their dietary choices and as a result, have a less healthy diet. By influencing the types of food made available, it would be possible to improve the overall diet among these children (Temple *et al.*, 2006).

In 1994, the Department of Health implemented the Primary School Nutrition Programme (PSNP) which aimed to improve the health and nutritional status of South African primary school children, improve levels of school attendance and improve the learning capacity of children by providing a nutritious meal to learners in lower income primary schools. In 2004, the programme was reallocated to the Department of Basic Education and was renamed the National School Nutrition Programme which allowed the programme to focus on secondary schools as well as primary schools (Department of Basic Education, 2012). The meal provided to learners as part of the programme includes a food item from each of the following food groups: Protein (including soya, fish, eggs, milk, beans or lentils), carbohydrate or starch (rice, bread or maize), fats, oils and salt (added for taste) and fruit or vegetable (should be served daily where possible). The meal should be served to the learners by 10:00 am, and where breakfast is served before school starts, the main meal may be served later in the day (Department of Basic Education, 2012). The provision of a meal through the NSNP provides a significant contribution to food intake among South African adolescents from lower socio-economic background. Given that 19% of children in South Africa do not eat breakfast before going to school, the provision of a meal by 10:00

am by the NSNP helps to provide key nutrients which might have otherwise been missed (Department of Basic Education, 2012; Shisana *et al.*, 2013).

In 2010, the president of South Africa committed to reinstating health programmes in public schools in South Africa (Department of Health & Department of Basic Education, 2012). In 2012, the South African government became signatory to the United Nations Convention on the Rights of the Child and accorded children in the Bill of Rights in the South African Constitution. The purpose of this was to ensure children's rights were upheld, which is particularly difficult in the South African context as a result of poverty, underdevelopment and barriers to optimal health. In order to address this need, the Integrated School Health Programme (IHSP) was implemented in South Africa in 2012. According to the World Health organisation (WHO) a school health programme is a combination of services aiming to ensure physical, mental and social wellbeing of learners so that they are better able to learn and reach their full potential. Because children spend around 13 years in the classroom environment, this provides an ideal opportunity for health education and intervention, which in turn can be shared by the children with their families and communities (Department of Health & Department of Basic Education, 2012).

The ISHP in South Africa has the following objectives:

- To provide preventive and promotive services that address the health needs of children;
- To support learning by identifying and addressing health barriers to learning;
- To facilitate access to health service where required and
- Support the community to create an environment suitable for teaching and learning.

These objectives are to be achieved through the collaboration of governmental departments and various role players and stakeholders by up-weighting existing health promotive programmes in schools. Nutrition has been highlighted as a key focus area in the ISHP and nutrition status and education of learners is being addressed by the ISNP in the following ways:

- Nutrition and exercise education is included as part of the Life Orientation subject curriculum;
- Anthropometric measures for each learner are being assessed to determine the risk for nutrition-related illnesses. Where nutrition illnesses are detected, effective intervention plans are implemented accordingly;

- Nutrition was identified as a key focus area in the Care and Support for Teaching and Learning Programme which focusses on delivery and expanding appropriate care to schools;
- Up-weighting of the Integrated Nutrition Program (INP) focussing on house-hold food security, health monitoring and promotion, control of micronutrient deficiencies, nutrition education and disease specific nutrition support and
- The NSNP providing nutrition meals to learners in need.

Through the implementation of the ISHP, children are exposed to nutrition education and interventions which improve their nutrition status overall (Department of Health & Department of Basic Education, 2012).

2.6.1.3.2 Fast food facilities

Fast food outlets hold significant appeal for the adolescent population. This is largely because the foods provided by these outlets are tasty, convenient and generally low cost. In the US, fast food outlets provide a third of away-from-home meals to adolescents (Lin *et al.*, 1996)

In South Africa, exposure to fast foods is much greater as a result of increasing informal food vendors and formal commercial vendors as part of urbanisation (Feeley *et al.*, 2012). Research conducted by Feeley *et al.* (2012) reported that the five most popular fast foods among South African adolescents were fried chips, “vetkoek”, fried fish, pies and “boerewors” which accounts for 74% of the total fast foods consumed in the population group. Informal vendors in South Africa make fast foods more affordable and accessible to people with lower incomes and the availability of confectionary and is widespread in schools and the community.

Because of the readily-available, cost effective nature of fast foods around schools and the community, the need or priority to eat breakfast at home before coming to school may be lessened. As a result, the nutritional quality of the foods typically consumed for breakfast among this population is compromised.

2.6.1.4 Macro-system or societal influences

Macro-system factors have an indirect role in influencing food behaviours, and examples include mass media and advertising, food production and distribution systems, national laws and policies guiding food supply issues, as well as social and cultural norms with regard to food (Story *et al.*, 2002). These influences have a much broader effect which guides trends and the environment of whole communities and countries.

South Africa is a third world country undergoing a unique nutrition transition, and as a result of this, environmental and dietary exposures vary greatly from those experienced in developed countries (Feeley *et al.*, 2012; Stupar *et al.*, 2012). The nutrition transition is driven by several aspects of economic globalisation such as urbanisation, changes in income, Westernisation of readily available foods, industry and marketing behaviour (Steyn *et al.*, 2006; Stupar *et al.*, 2012).

Cultural behaviours and stigmatization as a result of South Africa's history and the nutrition transition transforming the landscape of foods available to the public are influencing food and dietary choices among adolescents. According to (Stupar *et al.*, 2012), given the disadvantaged background of the majority of South Africans, there is a desire to display a successful image by choosing foods which are related to wealth and status. Alternatively, parents may wish to give their children foods to which they themselves were not exposed when they were young. Unfortunately, the manifestation of this behavior is a switch from traditional staple grains to Westernized energy-dense processed foods as part of the nutrition transition (Steyn *et al.*, 2006).

One way of influencing cultural beliefs and stigmatizations is by ensuring that the advertising food and beverages to children and adolescents is appropriate and promotes consistent health messages. By allowing food advertisements for unhealthy foods to be displayed to communities, confusing messages are reinforced among the public, creating a need for foods which are associated with success rather than health (Stupar *et al.*, 2012).

In the case of breakfast, fast food manufacturers are increasingly promoting consumption of fast foods as a convenient, quick breakfast. Given that adolescents are susceptible to the media and this type of advertising, the impact of these advertisements will cause switching from traditional breakfast meals to refined high fat alternatives, decreasing overall diet quality for adolescents.

There is a strong need to explore contextual factors affecting breakfast behaviour among adolescents (Merten *et al.*, 2009). Identifying important changeable determinants is critical to the development and implementation of relevant and effective interventions within the target group (Dejong *et al.*, 2009; Hallstrom *et al.*, 2011).

2.7 Conclusion

Although regular breakfast consumption has been identified as an important indicator of a healthy lifestyle by several groups of international researchers (Rampersaud *et al.*, 2005), global trends have shown that the prevalence of regular breakfast consumption is declining (Haines *et al.*, 1999). This trend has also been observed in the adolescent population globally (Seiga-Riz *et al.*, 2000). Adolescents are at particular risk for poor lifestyle behaviours (Frech, 2012). Research has shown that lifestyle and behaviour habits which are entrenched during adolescence are likely to remain throughout adulthood (Merten *et al.*, 2009). In order to address breakfast skipping behaviour among adolescents, the prevalence of breakfast skipping, the factors associated with breakfast skipping and the mechanisms explaining the effectiveness of breakfast in improving health outcomes must be understood (Breuning *et al.*, 2011; Kothe *et al.*, 2011; Ortega *et al.*, 1998b).

Regular breakfast intake is associated with decreased risk for obesity, decreased risk for chronic diseases, improved cognitive performance, behavioural and psychological importance, and improved nutrient intake and diet quality. However, the quality and nutrient composition of the optimal breakfast to illicit these beneficial effects are largely under review. While mechanisms for various nutrient properties, meal frequency and time of consumption lending to the observed benefits of breakfast have been proposed, further research is required to guide recommendations for the optimal breakfast composition.

Reported inconsistencies regarding the relationship between breakfast intake and level of physical activity indicates that this is not a conclusive mechanism for the observed benefits of breakfast intake in protecting against increased BMI and obesity. Further investigation is required to determine whether a causal relationship exists between these observations.

It has been suggested that intake of breakfast, and the quality of the breakfast consumed, may influence the rest of the day's intake affecting overall diet quality (Nicklas *et al.*, 1998). Foods and nutrients consumed at breakfast may affect food choices and behaviour which follow throughout the rest of the day, predisposing breakfast eaters to healthier, more nutritious choices when compared to breakfast skippers (Nicklas *et al.*, 1998). Further research to better understand the effect of different breakfast formats and compositions on subsequent daily intake is required.

It has been theorised that breakfast behaviour is influenced by a number of interlinked factors, broadly categorised as intrapersonal, interpersonal, physical-environmental or macro-system. While no one factor can be truly predictive of an adolescent's eating

behaviour, a matrix of interacting factors may guide understanding cultural, environmental, relationship and personal factors affecting breakfast intake (Story *et al.*, 2002).

Intrapersonal factors which have been reported to affect adolescent food choices include the taste and flavours of different foods, the cost and accessibility of foods, age, gender and personal attitudes and beliefs (Yeung, 2010). Addressing attitude and food beliefs may be more important than knowledge in altering food-related health behaviour (Nowak & Buttner, 2003). Interpersonal influences include family, peers and SES (Story *et al.*, 2002). Physical environmental influences are the surrounds to which adolescents are exposed, guiding food availability. Macro-systems refer to broader influential systems such as mass media, political environment and population culture.

Identifying the changeable determinants of adolescent breakfast behaviour, and understanding the mechanism by which different nutrients in a breakfast meal illicit beneficial health outcomes, are key to developing effective public health guidelines and interventions.

2.8 References

- Affenito, S.G., Thompson, D.R., Barton, B.A., Franko, D.L., Daniels, S.R., Obarzanek, E., et al. 2005. Breakfast Consumption by African-American and White Adolescent Girls Correlates Positively with Calcium and Fiber Intake and Negatively with Body Mass Index. *Journal of the American Dietetic Association*, 105 (6) :938-945.
- Ajzen, I. 1991. The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes*, 50:179-211.
- Albertson, A.M., Frank, D.L., Thompson, D., Eldridge, A.L., Holschuh, N., Affenito, S.G., et al. 2007. Longitudinal patterns of breakfast eating in black and white adolescent girls. *Obesity*, 15 (9) :2282-2292.

Alexander, K.E., Ventura, E.E., Spruijt-Metz, D., Weigensberg, M.J., Goran, M.I. & Davis, J.N. 2009. Association of breakfast skipping with visceral fat and insulin indices in overweight Latino youth. *Obesity*, 17 (8) :1528-1533.

Anon. 1998. A day in the life of a teen's appetite. *Channel One Network*: New York.

Anon. 2013. Online Etymology Dictionary.

http://www.etymonline.com/index.php?term=breakfast&allowed_in_frame=0 Date of access: 1 November 2013.

Aranceta, J., Serra-Majem, L., Ribas, L. & Perez-Rodrigo, C. 2001. Breakfast consumption in Spanish children and young people. *Public Health Nutrition*, 4(6A) :1439-1444.

Baranowski, T., Perry, C. & Parcel, G. 1997. How individuals, environments and health behaviour interact: Social Cognitive Theory. San Francisco, California: Jossey.

Barlow, S.E. 2007. Expert Committee recommendations regarding the prevention, assessment and treatment of child and adolescent overweight and obesity: Summary report. *Pediatrics*, 120:S164-S192.

Barton, B.A., Eldridge, A.L., Thompson, D., Affenito, S.G., Streigel-Moore, R.H., Franko, D.L., et al. 2005. The relationship of breakfast and cereal consumption to nutrient intake and body mass index: The National Heart, Lung, and Blood Institute Growth and Health Study. *Journal of the American Dietetic Association*, 105 (1383-1389) .

Belloc, N.B. & Breslow, L. 1972. Relationship of Physical Health Status and Health Practices. *Preventive Medicine*, 1:409-421.

Berg, C., Jonsson, O., Conner, M. & Lissner, L. 2003. Perceptions and reasons for choice of fat- and fibre-containing foods by Swedish schoolchildren. *Appetite*, 40:61-67.

Breuning, M., Eisenberg, M., MacLehose, R., Nannery, M.S., Story, M. & Neumark-Sztainer, D. 2012. Relationship between Adolescents' and Their Friends' Eating Behaviours: Breakfast, Fruit, Vegetable, Whole-Grain, and Dairy Intake. *Journal of the Academy of Nutrition and Dietetics*, 112(10) :1608-1613.

Breuning, M., Larson, N., Story, M., Neumark-Sztainer, D. & Hannan, P. 2011. Predictors of adolescent breakfast consumption: Longitudinal findings from project EAT. *Journal of Nutrition Education and Behaviour*, 43(5) :390-395.

Brindal, E., Baird, D. & Danthiir, V. 2012. Ingesting breakfast meals of different glycaemic load does not alter cognition and satiety in children. *European Journal of Clinical Nutrition*, 66:1166-1171.

Burghardt, J., Gprdon, A., Chapman, N., Gleason, P.M. & Fraker, T. 1993. The school nutrition dietary assessment study: School food service, meals offered and dietary intakes. Princeton, NJ: Mathematica Policy Research Inc.

Cho, S., Dietrich, M., Brown, C., Clark, C. & Block, G. 2003. The effect of breakfast type on total daily energy intake and body mass index: results from the Third National Health and

Nutrition Examination Survey (NHANES III) . *Journal of the American College of Nutrition*, 22:296-302.

Chugani, H. 1998. A critical period of brain development: studies of cerebral glucose utilisation with PET. *Preventive Medicine*, 27:184-188.

Corder, K., van Sluijs, E., Steele, R., Stephen, A., Dunn, V., Bamber, D., et al. 2011. Breakfast consumption and physical activity in British adolescents. *British Journal of Nutrition*, 105:316-321.

de Castro, J. 2004. The time of day of food intake influences overall intake in humans. *Journal of Nutrition*, 134 (1) :104-111.

de la Hunty, A., Gibson, S. & Ashwell, M. 2013. Does regular breakfast consumption help children and adolescents stay slimmer? A systematic review and meta-analysis. *The European Journal of Obesity*, 6:70-85.

de Moraes, A.C.F., Adami, F. & Falcao, M.C. 2012. Understanding the correlates of adolescents' dietary intake patterns. A multivariate analysis. *Appetite*, 58:1057-1062.

Dejong, C.S., van Lenthe, F.J., van der Horst, K. & Oenema, A. 2009. Environmental and cognitive correlates of adolescent breakfast consumption. *Preventive Medicine*, 48:372-377.

Delva, J., O'Malley, P.M. & Johnston, L. 2006. Racial/Ethnic and Socioeconomic Status Differences in Overweight and Health-related Behaviours among American Students: National Trends 1986-2003. *Journal of Adolescent Health*, 39:536-545.

Department of Basic Education. 2012. *National school nutrition programme (NSNP) annual report.*

Department of Health. 2004. *South Africa Demographic and Health Survey 1998.*

Department of Health. 2007. *South Africa Demographic and Health Survey 2003.*

Department of Health & Department of Basic Education. 2012. *Integrated School Health Policy.*

Deshmukh-Taskar, P.R., Nicklas, T.A., O'Neil, C.E., Keast, D.R., Radcliffe, J.D. & Cho, S. 2010. The Relationship of Breakfast Skipping and Type of Breakfast Consumption with Nutrient Intake and Weight Status in Children and Adolescents: The National Health and Nutrition Examination Survey 1999-2006. *Journal of the American Dietetic Association*, 110(6) :869-878.

Di Guiseppe, R., Di Castelnuovo, A., Melegari, C., De Lucia, F., Santimone, I., Sciarretta, A., et al. 2012. Typical breakfast food consumption and risk factors for cardiovascular disease in a large sample of Italian adults. *Nutrition, Metabolism & Cardiovascular Diseases*, 22:347-354.

Dialektakou, K.D. & Vranas, P.B.M. 2008. Breakfast Skipping and Body Mass Index among Adolescents in Greece: Whether an Association Exists Depending on How Breakfast Skipping is Defined. *Journal of the American Dietetic Association*, 108:1517-1525.

Dickie, N. & Bender, A. 1982. Breakfast and performance in school children. *British Journal of Nutrition*, 48:483-496.

Elgar, F., Roberts, C., Moore, L. & Tudor-Smith, C. 2005. Sedentary behaviour, physical activity and weight problems in adolescents in Wales. *Public Health*, 119:518-524.

Estima, C.d.C.P., Costa, R.S.d., Sichieri, R., Pereira, R.A. & Veiga, G.V.d. 2009. Meal consumption patterns and anthropometric measurements in adolescents from a low socioeconomic neighborhood in the metropolitan area of Rio de Janeiro, Brazil. *Appetite*, 52:735-739.

Farshchi, H., Taylor, M. & Macdonald, I. 2005. Deleterious effects of omitting breakfast on insulin sensitivity and fasting lipid profiles in healthy lean women. *American Journal of Clinical Nutrition*, 81:388-396.

Feeley, A., Musenge, E., Pettifor, J.M. & Norris, S.A. 2012. Changes in dietary habits and eating practices in adolescents living in urban South Africa: The birth to twenty cohort. *Nutrition*, 28:e1-e6.

Feunekes, G., de Graaf, C., Meyboom, S. & van Staveren, W. 1998. Food choice and fat intake of adolescents and adults: Associations of intakes within social networks. *Preventive Medicine*, 27:645-656.

Fiore, H., Travis, S., Whalen, A., Auinger, P. & Ryan, S. 2006. Potentially Protective Factors Associated with Healthful Body Mass Index in Adolescents with Obese and Nonobese

Parents: A Secondary Data Analysis of the Third National Health and Nutrition Examination Survey, 1988-1994. *Journal of the American Dietetic Association*, 106(1) :55-64.

Flint, A., Raben, A., Ersboll, A., Holst, J. & Astrup, A. 2001. The effect of physiological levels of glucagon-like peptide 1 on appetite, gastric emptying, energy and substrate metabolism in obesity. *International Journal of Obesity Related Metabolic Disorders*, 25(6) :781-792.

Frech, A. 2012. Healthy behaviour trajectories between adolescence and young childhood. *Advances in Life Course Research*, 17:59-68.

French, S., Story, M., Hannan, P., Breitlow, K., Jefferey, R., Baxter, J., et al. 1999. Cognitive and demographic correlates of low fat vending snack choices among adolescents and adults. *Journal of the American Dietetic Association*, 99:471-475.

Gable, S. & Lutz, S. 2000. Household, parent and child contributions to childhood obesity. *Fam Relat*, 49:293-300.

Gibson, E. 2007. Carbohydrates and mental function: feeding or impeding the brain? *Nutrition Bulletin*, 32(1) :71-83.

Gibson, R. 2005. Principles of Nutritional assessment. Vol. 2nd ed. Dunedin: Oxford University Press.

Gibson, S. & Gunn, P. 2011. What's for breakfast? Nutritional implications of breakfast habits: insights from NDNS dietary records. *British Nutrition Foundation Nutrition Bulletin*, 36:78-86.

Giovannini, M., Agostoni, C. & Shamir, R. 2010. Symposium overview: Do we all eat breakfast and is it important? *Critical Reviews in Food Science and Nutrition*, 50(2) :97-99.

Glanz, K. & Rimer, B. 1995. Theory at a glance: A guide for health promotion and practice. Washington: Department of Health and Human Services; National Cancer Institute; National Institutes of Health.

Gleason, P.M. 1995. Participation in the National School Lunch Program and the School Breakfast Program. *American Journal of Clinical Nutrition*, 61:213S-220S.

Gomez-Martinez, S., Martinez-Gomez, D., Heredia, F.P.d., Romeo, J., Cuenca-Garcia, M., Martin-Matillas, M., et al. 2012. Eating Habits and Total and Abdominal Fat in Spanish Adolescents: Influence of Physical Activity. The AVENA Study. *Journal of Adolescent Health*, 50:403-409.

Gordon-Larsen, P., Adair, L.S., Nelson, M.C. & Popkin, B.M. 2004. Five-year obesity incidence in the transition between adolescence and adulthood: the National Longitudinal Study of Adolescent Health. *American Journal of Clinical Nutrition*, 80:669-575.

Grieger, J. & Cobiac, L. 2012. Comparison of dietary intakes according to breakfast choice in Australian boys. *European Journal of Clinical Nutrition*, 66:667-672.

Gwinup, G., Kruger, F. & Hamwi, G. 1964. Metabolic effects of gorging vs nibbling. *Ohio State Medical Journal*, 60(7) :663-666.

Haines, J., Neumark-Sztainer, D., Wall, M. & Story, M. 2007. Personal, behavioural and environmental risk and protective factors for adolescent overweight. *Obesity*, 15:2748-2760.

Haines, P.S., Guilkey, D.K. & Popkin, B.M. 1996. Trends in breakfast consumption of US adults between 1965 and 1991. *Journal of the American Dietetic Association*, 96:464-470.

Haines, P.S., Siega-Riz, A.M. & Popkin, B.M. 1999. The Diet Quality Index Revised: A measurement instrument for populations. *Journal of the American Dietetic Association*, 99 (6) :697-704.

Hallstrom, L., Vereecken, C.A., Ruiz, J.R., Patterson, E., Gilbert, C.C., Catasta, G., et al. 2011. Breakfast habits and factors influencing food choices at breakfast in relation to socio-demographic and family factors among European adolescents. The HELENA Study. *Appetite*, 56:649-657.

Halsey, L.G., Huber, J.W., Low, T., Ibeawuchi, C., Woodruff, P. & Reeves, S. 2011. Does consuming breakfast influence activity levels? An experiment into the effect of breakfast consumption on eating habits and energy expenditure. *Public Health Nutrition*, 15(2) :238-245.

Harding, S., Teyhan, A., Maynard, M. & Cruickshank, J. 2008. Ethnic differences in overweight and obesity in early adolescence in the MRC DASH Study: the role of adolescent and parental lifestyle. *International Journal of Epidemiology*, 37:162-172.

Herrero, L.R. & Fillat, B.J. 2006. A study on breakfast and school performance in a group of adolescents. *Nutr Hosp*, 21:346-352.

Horikawa, C., Kodama, S., Yachi, Y., Heianza, Y., Hirasawa, R., Ibe, Y., et al. 2011. Skipping breakfast and prevalence of overweight and obesity in Asian and Pacific regions: A meta-analysis. *Preventive Medicine*, 53:260-267.

Hoyland, A., Dye, L. & Lawton, C.L. 2009. A systematic review of the effect of breakfast on the cognitive performance of children and adolescents. *Nutrition Research Reviews*, 22:220-243.

Jaaskelainen, A., Schwab, U., Kolehmainen, M., Pirkola, J., Jarvelin, M. & Laitinen, J. 2012. Associations of meal frequency and breakfast with obesity and metabolic syndrome traits in adolescents of Northern Finland Birth Cohort 1986. *Nutrition, Metabolism & Cardiovascular Diseases*:1-8.

Jenkins, D., Wolever, T. & Vuksan, V. 1989. Nibbling vs gorging: metabolic advantages of increased meal frequency. *New England Journal of Medicine*, 321(14) :929-934.

Jovanovic, A., Gerrard, J. & Taylor, R. 2009. The second-meal phenomenon in type 2 diabetes. *Diabetes Care*, 32:1199-1201.

Kaplan, G., Seeman, T., Cohen, R., Knudsen, L. & Guralnik, J. 1987. Mortality among the elderly in the Alameda County Study: behavioural and demographic risk factors. *American Journal of Public Health*, 77(3) :307-312.

Kent, L.M. & Worsley, A. 2010. Breakfast size is related to body mass index for men, but not women. *Nutrition Research*, 30:240-245.

Keski-Rahkonen, A., Kaprio, J., Rissanen, A., Virkkunen, M. & Rose, R. 2003. Breakfast skipping and health compromising behaviours in adolescents and adults. *European Journal of Clinical Nutrition*, 57:842-853.

Kontogianni, M.D., Farmaki, A.-E., Vidra, N., Sofrona, S., Magkanari, F. & Yannakoulia, M. 2010. Associations between Lifestyle Patterns and Body Mass Index in a Sample of Greek Children and Adolescents. *Journal of the American Dietetic Association*, 110 (2) :215-221.

Kothe, E.J., Mullan, B.A. & Amaratunga, R. 2011. Randomised controlled trial of a brief theory-based intervention promoting breakfast consumption. *Appetite*, 56:148-155.

Kourlaba, G. & Panagiotakos, D.B. 2009. Dietary quality indices and human health: A review. *Maturitas*, 62:1-8.

Kruger, H., Dhansay, M., Labadarios, D., Kotiah, M. & Kullman, L. 2002. The importance of breakfast in meeting nutritional requirements of South African children. *South African Journal of Clinical Nutrition*, 15 (1) .

Lattimore, P.J. & Halford, J.C.G. 2003. Adolescence and the diet-dieting disparity: Healthy food choice or risky health behaviour? *British Journal of Health Psychology*, 8:451-463.

Leidy, H., Bossingham, M., Mattes, R. & Campbell, W. 2009. Increased dietary protein consumed at breakfast leads to an initial and sustained feeling of fullness during energy restriction compared to other meal times. *British Journal of Nutrition*, 101:798-803.

Leidy, H.J. 2012. The benefits of breakfast consumption to combat obesity and diabetes in young people. *American Journal of Lifestyle Medicine*, 7:99-103.

Levin, K.A. & Kirby, J. 2012. Irregular breakfast consumption in adolescence and the family environment: Underlying causes by family structure. *Appetite*, 59:63-70.

Liljeberg, H., Akerberg, A. & Bjorck, I. 2001. The effect of the glycaemic index and content of indigestible carbohydrates of cereal-based breakfast meals on glucose tolerance at lunch in healthy subjects. *American Journal of Clinical Nutrition*, 69 (4) :647-655.

Lin, B., Guthrie, J. & Blaylock, J. 1996. The diets of America's children: influences of dining out, Household characteristics and nutrition knowledge. Washington DC: US Department of Agriculture.

Lopez-Sobaler, A., Ortega, R. & Quintas, M. 2003. Relationship between habitual breakfast and intellectual performance (logical reasoning) in well-nourished school children of Madrid (Spain) . *European Journal of Clinical Nutrition*, 57 (1) :49-53.

Lui, S., Sesso, H., Manson, J., Willett, W. & Buring, J. 2003. Is intake of breakfast cereals related to total and cause-specific mortality in men? *American Journal of Clinical Nutrition*, 77 (3) :594-599.

Lytle, L., Seifert, S., Greenstein, J. & McGovern, P. 2000. How do children's eating patterns and food choices change over time? Results from a cohort study. *American Journal of Health Promotion*, 14:222-228.

MacNicol, S.A., Murray, S.M. & Austin, E.J. 2003. Relationships between personality, attitudes and dietary behaviour in a group of Scottish adolescents. *Personality and Individual Differences*, 35:1753-1764.

Maddah, M. 2008. Risk factors for overweight in urban and rural school girls in Iran: Skipping breakfast and early menarche. 18 July 2008 uitg.: Elsevier Ireland Ltd. 235-238 p.

Maffeis, C., Fornari, E., Surano, M., Comencini, E., Corradi, M., Tommasi, M., et al. 2012. Breakfast skipping in prepubertal obese children: hormonal, metabolic and cognitive consequences. *European Journal of Clinical Nutrition*, 66:314-321.

Matthys, C., De Henauw, S., Bellemans, M., De Maeyer, M. & De Backer, G. 2007. Breakfast habits affect overall nutrient profiles in adolescents. *Public Health Nutrition*, 10 (4) :413-421.

McLeroy, K., Bibeau, D., Steckler, A. & Glanz, K. 1988. An ecological perspective on health promotion programs. *Health Educ Q*, 15:351-377.

Merten, M.J., Williams, A.L. & Shriver, L.H. 2009. Breakfast Consumption in Adolescence and Young Adulthood: Parental Presence, Community Context, and Obesity. *Journal of the American Dietetic Association*, 109(8) :1384-1391.

Miller, K.B., Liska, D.J. & Fulgoni, V.L. 2013. The association between body metrics and breakfast food choice in children. *Infant, child and adolescent nutrition*, 5:43-50.

Morales, I., Villas, M. & Vega, C. 2008. Relation between the breakfast quality and academic performance in adolescents of Guadalajara. *Nutr Hosp*, 23:383-387.

Moshfegh, A., Goldman, J. & Cleveland, L. 2002. *What we eat in America; NHANES 2001-2002: usual nutrient intakes from food compared to dietary reference intakes, in breakfast in America.*

Mullan, B., Wong, C., Kothe, E. & MacCann, C. 2013. Predicting breakfast consumption: A comparison of the theory of planned behaviour and the health action process approach. *British Food Journal*, 115(11) :1-43.

Nestler, J., Barlascini, C., Clore, J. & Blackard, W. 1988. Absorption characteristic of breakfast determines insulin sensitivity and carbohydrate tolerance for lunch. *Diabetes Care*, 11 (10) :755-760.

Nicklas, T., Bao, W., Webber, L. & Bereson, G. 1993. Breakfast consumption affects adequacy of total daily intake in children. *Journal of the American Dietetic Association*, 93:886-891.

Nicklas, T.A., Myers, L., Reger, C., Beech, B. & Berenson, G.S. 1998. Impact of Breakfast Consumption on Nutritional Adequacy of the Diets of Young Adults in Bogalusa, Louisiana: Ethnic and Gender Contrasts. *Journal of the American Dietetic Association*, 98 (12) :1432-1438.

Nicklas, T.A., Reger, C., Myers, L. & O'Neil, C. 2000. Breakfast Consumption With and Without Vitamin-Mineral Supplement Use Favorably Impacts Daily Nutrient Intake of Ninth-Grade Students. *Journal of Adolescent Health*, 27:314-321.

Niemeier, H.M., Raynor, H.A., Lloyd-Richardson, E.E., Rogers, M.L. & Wing, R.R. 2006. Fast Food Consumption and Breakfast Skipping: Predictors of Weight Gain from Adolescence to Adulthood in a Nationally Representative Sample. *Journal of Adolescent Health*, 39:842-849.

Nowak, M. & Buttner, P. 2003. Relationship between adolescents' food-related beliefs and food intake behaviours. *Nutrition Research*, 23:45-55.

O'Dea, J.A. & Mugridge, A.C. 2012. Nutritional quality of breakfast and physical activity independently predict the literacy and numeracy scores of children after adjusting for socioeconomic status. *Health Education Research*, 2012:1-11.

O'Sullivan, T.A., Robinson, M., Kendall, G.E., Miller, M., Jacoby, P., Silburn, S.R., et al. 2009. A good-quality breakfast is associated with better mental health in adolescence. *Public Health Nutrition*, 12(2) :249-258.

Ortega, R., Requejo, A. & Lopez-Sobaler, A. 1998a. Differences in the breakfast habits of overweight, obese and normal weight school children. *Int J Vitam Nutr Res*, 68:125-132.

Ortega, R.M., Requejo, A.M., Navia, B., Lopez-Sobaler, A.M., Quintas, M.E., Andres, P., et al. 1998b. The relationship between the consumption of an inadequate breakfast and energy profile imbalance in preschool children. *Nutrition Research*, 18(4) :703-712.

Panagiotakos, D.B., Antonogeorgos, G., Papadimitriou, A., Anthracopoulos, M.B., Papadopoulou, M., Konstantinidou, M., et al. 2008. Breakfast cereal is associated with a lower prevalence of obesity among 10-12-year-old children: The PANACEA study. *Nutrition, Metabolism & Cardiovascular Diseases*, 18:606-612.

Patterson, R., Haines, P. & Popkin, B. 1994. Diet Quality Index: capturing a multidimensional behaviour. *Journal of the American Dietetic Association*, 94:57-64.

Pearson, N., Briddle, S.J. & Gorely, T. 2009. Family correlates of breakfast consumption among children and adolescents: A systematic review. *Appetite*, 52:1-7.

Pereira, M. & Ludwig, D. 2001. Dietary fibre and body weight regulation. Observations and mechanisms. *Pediatric Clinical Journal of North America*, 48(4) :969-980.

Pereira, M.A., Erickson, E., McKee, P., Schrankler, K., Raatz, S.K., Lylte, L.A., et al. 2011. Breakfast frequency and quality may affect glycaemic and appetite in adults and children. *The Journal of Nutrition*, 141(1) :163-168.

Preziosi, P., Galan, P., Deheeger, M., Yacoub, N., Drenowski, A. & Hereberg, S. 1999. Breakfast type, daily nutrient intakes, and vitamin and mineral status of French children, adolescents and adults. *Journal of the American College of Nutrition*, 18:171-178.

Radcliffe, B., Ogden, C., Coyne, T. & Craig, P. 2004. Breakfast consumption patterns of upper primary schools students in 14 Queensland schools. *Nutrition and Dietetics: the Journal of the Dietitians Association of Australia*, 61(3) :151-158.

Rampersaud, G. 2008. Benefits of breakfast for children and adolescents: Update and recommendations for practitioners. *American Journal of Lifestyle Medicine*, 3:86-103.

Rampersaud, G., Pereira, M., Girard, B., Adams, J. & Metz, J. 2005. Breakfast habits, nutritional status, body weight and academic performance in children and adolescents. *Journal of the American Dietetic Association*, 105:743-760.

Roseman, M.G., Yeung, W.K. & Nickelson, J. 2007. Examination of Weight Status and Dietary Behaviours of Middle School Students in Kentucky. *Journal of the American Dietetic Association*, 107:1139-1145.

Ruxton, C., O'Sullivan, K., Kirk, T. & Belton, N. 1996. Breakfast in the diets of Scottish schoolchildren. *British Journal of Nutrition*, 75 (3) :419-431.

Sandercock, G., Voss, C. & Dye, L. 2010. Associations between habitual school-day breakfast consumption, body mass index, physical activity and cardiorespiratory fitness in English schoolchildren. *European Journal of Clinical Nutrition*, 64:1086-1092.

Schembre, S.M., Wen, C.K., Davis, J.N., Shen, E., Nguyen-Rodriguez, S.T., Belcher, B.R., et al. 2013. Eating breakfast more frequently is cross-sectionally associated with greater physical activity and lower levels of adiposity in overweight Latina and African American girls. *American Journal of Clinical Nutrition*, 98:275-281.

Scholey, A., Sunram-Lea, S., Greer, J., Elliott, J. & Kennedy, D. 2009. Glucose administration prior to a divided attention task improves tracking performance but not word

recognition: evidence against differential memory enhancement? *Psychopharmacology*, 202:539-558.

Seiga-Riz, A.M., Popkin, B.M. & Carson, T. 2000. Differences in food patterns at breakfast by sociodemographic characteristics among a nationally representative sample of adults in the United States. *Preventive Medicine*, 30:415-424.

Shaw, M.E. 1998. Adolescent breakfast skipping: An Australian study. *Adolescence*, 33(132) :851-861.

Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., et al. 2013. South African National Health and Nutrition Examination Survey SANHANES-1. Cape Town: HSRC Press.

Siege-Riz, A., Popkin, B. & Carson, T. 1998. Trends in breakfast consumption for children in the United States from 1965-1991. *American Journal of Clinical Nutrition*, 67:748s-756s.

Smith, K.J., Gall, S.L., McNaughton, S.A., Blizzard, L., Dwyer, T. & Venn, A.J. 2010. Skipping breakfast: longitudinal associations with cardiometabolic risk factors in the Childhood Determinants of Adult Health Study. *American Journal of Clinical Nutrition*, 92:1316-1325.

Stephens, K. & Summar, S. 2008. Dietary interventions for the treatment of obese children and adolescents. *Progress in Pediatric Cardiology*, 25:137-141.

Stevenson, C., Doherty, G., Barnett, J., Muldoon, O.T. & Trew, K. 2007. Adolescents' views of food and eating: Identifying barriers to healthy eating. *Journal of Adolescence*, 30:417-434.

Steyn, K., Fourie, J. & Temple, N. 2006. *Chronic Diseases of Lifestyle in South Africa: 1995 – 2005*. Cape Town: South African Medical Research Council.

Steyn, N. 2010. Does dietary knowledge influence the eating behaviour of adolescents? *South African Journal of Clinical Nutrition*, 23(2) :62-63.

Stockman, N.K., Schenkel, T.C., Brown, J.N. & Duncan, A.M. 2005. Comparison of energy and nutrient intakes among meals and snacks of adolescent males. *Preventive Medicine*, 41:203-210.

Story, M., Neumark-Sztainer, D. & French, S. 2002. Individual and environmental influences on adolescent eating behaviours. *Journal of the American Dietetic Association*, 102(3) :S40-S51.

Stupar, D., Eide, W.B., Bourne, L., Hendricks, M., Iversen, P.O. & Wandel, M. 2012. The nutrition transition and the human right to adequate food for adolescents in the Cape Town metropolitan area: Implications for nutrition policy. *Food Policy*, 37:199-206.

Temple, N.J., Steyn, N.P., Myburgh, N.G. & Nel, J.H. 2006. Food items consumed by students attending schools in different socioeconomic areas in Cape Town. *Nutrition*, 22:252-258.

Timlin, M.T. & Pereira, M.A. 2007. Breakfast frequency and quality in the etiology of adult obesity and chronic diseases. *Nutrition Reviews*, 65(6) :268-281.

Tin, S.P.P., Ho, S.Y., Mak, K.H., Wan, K.L. & Lam, T.H. 2011. Lifestyle and socioeconomic correlates of breakfast skipping in Hong Kong primary 4 schoolchildren. *Preventive Medicine*, 52:250-253.

van den Boom, A., Serra-Majem, L., Ribas, L., Ngo, J., Perez-Rodrigo, C., Aranceta, J., et al. 2006. The contribution of ready-to-eat cereals to daily nutrient intake and breakfast quality in a Mediterranean setting. *Journal of the American College of Nutrition*, 25 (2) :135-143.

Veltsista, A., Laitinen, J., Sovio, U., Roma, E., Jarvelin, M.-R. & Bakoula, C. 2010. Relationship between Eating Behaviour, Breakfast Consumption, and Obesity Among Finnish and Greek Adolescents. *Journal of Nutrition Education and Behaviour*, 42 (6) :417-421.

Vorster, H., Badham, J. & Venter, C. 2013. An introduction to the revised food-based dietary guidelines for South Africa. *South African Journal of Clinical Nutrition*, 26 (3) :S5-S12.

Walker, A., Walker, B., Jones, J. & Ncongwane, J. 1982. Breakfast habits of adolescents in four South African populations. *American Journal of Clinical Nutrition*, 36 (4) :650-656.

Wirt, A. & Collins, C.E. 2009. Diet quality - what is it and does it matter? *Public Health Nutrition*, 12 (12) :2473-2492.

Woodruff, S.J., Hanning, R.M., Lambraki, I., Storey, K.E. & McCargar, L. 2008. Healthy Eating Index-C is compromised among adolescents with body weight concerns, weight loss dieting, and meal skipping. *Body Image*, 5:404-408.

Yeung, W.-I.T.L. 2010. Gender Perspectives on Adolescent Eating Behaviours: A Study on the Eating Attitudes and Behaviours of Junior Secondary Students in Hong Kong. *Journal of Nutrition Education and Behaviour*, 42(4) :250-258.

Chapter 3 – Article



The photographs above have been used with permission and show fieldworkers conducting 24-hour recall questionnaires in various schools.

The intake and quality of breakfast consumption among adolescents attending public secondary schools in the Northwest Province, South Africa.

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¹ Abbreviations

AGHE: Australian Guide to Healthy Eating; BMI: Body Mass Index; BMR: Basal Metabolic Rate; DQI-R: Diet Quality Index Revised; EI: Energy Intake; ISAK: International Society for the Advancement of Kinanthropometry; NSNP: National School Nutrition Program; PAL: Physical Activity Level; RTEC: Ready-to-eat Cereal; SANHANES: South African National Health and Nutrition Examination Survey

Abstract

Objective

To determine the proportion and quality of breakfast consumption, and the effect of breakfast intake and quality on diet quality among adolescents in Potchefstroom, South Africa.

Method

Demographic information and dietary intake information were collected for 244 adolescents (mean age 17.5 ± 2.3). Breakfast and diet quality scores were applied. Spearman correlations were used to assess associations between continuous variables. The Chi-square or Fisher's Exact Test was used to assess the associations between categorical variables. A p-value < 0.05 indicated statistical significance.

Results

The proportion of breakfast intake and skipping was 81% and 19% respectively. The mean breakfast quality score was 3.1 indicating moderate quality. Breakfast eaters and skippers showed no significant difference in diet quality score. Breakfast quality score was marginally associated with calcium intake ($p < 0.0001$; $r = 0.418$), phosphorous intake ($p < 0.0001$; $r = 0.378$) and total diversity score ($p < 0.0001$; $r = 0.369$).

Conclusion

The proportion of breakfast skipping shown highlights the need for breakfast education and intervention as part of the Integrated School Health Policy.

Keywords:

Adolescent; Breakfast; Breakfast quality; Diet Quality; Adolescence

Introduction

Regular breakfast consumption among adolescents has been linked to decreased risk of obesity and chronic diseases, improved cognition and improved nutrient intake (Barton, et al., 2005; Deshmukh-Taskar, et al., 2010; Hoyland, Dye, & Lawton, 2009; Kruger, Dhansay, Labadarios, Kotiah, & Kullman, 2002; Smith, et al., 2010). Despite this, research has indicated that adolescent breakfast consumption is declining globally (Cho, Dietrich, Brown, Clark, & Block, 2003; Rampersaud, Pereira, Girard, Adams, & Metz, 2005; Seiga-Riz, Popkin, & Carson, 2000). The reported prevalence of breakfast skipping among different adolescent population groups in South Africa ranges from 13 to 36% (Feeley, Musenge, Pettifor, & Norris, 2012; N. J. Temple, Steyn, Myburgh, & Nel, 2006; Walker, Walker, Jones, & Ncongwane, 1982).

Adolescents are at particularly high-risk for health compromising behaviours such as increased fast food consumption, increased sedentary levels and frequent breakfast skipping (Frech, 2012; Niemeier, Raynor, Lloyd-Richardson, Rogers, & Wing, 2006). Adequate exercise and sleep, maintaining healthy weight, not smoking or binge drinking and eating breakfast regularly have declined dramatically during the transition to young adulthood (Frech, 2012; Niemeier, et al., 2006). Research shows that lifestyle and behaviour habits which are entrenched during adolescence are likely to remain throughout adulthood (Merten, Williams, & Shriver, 2009).

By studying the prevalence of breakfast skipping and the quality of breakfast consumed within a particular target group, research is able to create an understanding of the magnitude of the problem to be addressed. Understanding how breakfast intake and quality influences health outcomes guides effective recommendations for breakfast intake which can be used in public health guidelines and intervention programs (Breuning, Larson, Story, Neumark-Sztainer, & Hannan, 2011; Ortega, et al., 1998).

The aim of this study was to determine the proportion of adolescents eating breakfast, and the quality of breakfast consumed among adolescents attending public secondary schools in Potchefstroom and its surrounding areas in the Northwest Province of South Africa, and to determine the effect of breakfast intake and quality on overall diet quality and other lifestyle behaviours.

Methods

Research design

The study used a cross sectional quantitative design.

Study participants and sampling

The study focussed on randomly selected adolescents, both boys and girls, attending seven public secondary schools in grades nine to eleven residing in urban and peri-urban areas of Potchefstroom and its surrounding areas in the Northwest Province of South Africa. All secondary schools were entered into the eligibility pool for selection ($n = 19$). The schools were stratified for quintile (1 to 5) and then one school from each quintile was randomly selected using a randomiser tool. South African schools are divided into five categories or “quintiles” based on their poverty ranking (Hall & Giese, 2009). Quintile 1 represents the poorest schools and quintile 5 represents the least poor schools (Hall & Giese, 2009). This classification is determined through the implementation of a national poverty table which determines the poverty ranking of areas based on information from the national census and the catchment area of the school (Hall & Giese, 2009). Schools from all the quintiles were included in the study to ensure that a distribution of children attending different kinds of schools was represented, and that the research was not biased to one group of adolescents.

It was determined that data from 50 students from each quintile would be required to determine accurate means, standard deviation and to be able to compare quintiles with

each other. This was not proportional or representative of the total population in Potchefstroom and its surrounding areas. A list of students in grades 9 to 11 was obtained from each school, and students were randomly selected to take part in the study using a randomiser tool. Too few participants were available on the day of data collection from the schools in quintiles 4 and 5 due to unreturned consent forms, and therefore a second school representing each of these quintiles was selected, resulting in a total of seven schools being included in the study. A total of 254 adolescents were recruited.

Data collection

A self-administered demographic questionnaire was used to obtain information on gender, age, study year, basic health questions, participation in physical activity and other socio-demographic information.

To obtain information on breakfast and dietary intake for the day, a single 24-hour recall using the four-stage multiple pass method was conducted using food models and picture books to determine portion size. The dietary data was analysed using the Medical Research Council Food Composition Tables and was coded accordingly (Langenhoven, Conradie, Wolmarans, & Faber, 2002; Wolmarans, Danster, Dalton, Rossouw, & Schonfeldt, 2010). A self-administered questionnaire was used to select the type of breakfast usually consumed by the adolescents. For the purposes of this research, 'breakfast' was defined as any food or beverage consumed between 5 am and 10 am. A 'meal' was defined as an eating occasion and was categorised as breakfast (5 am – 10 am), morning snack (10 am – 12 pm), lunch (12 pm – 2 pm), afternoon snack (2 pm – 6 pm), dinner (6 pm – 8 pm) and evening snack (8 pm – 10 pm).

Breakfast quality was measured through the allocation of a breakfast quality score as described by Radcliffe and co-workers (Radcliffe, Ogden, Coyne, & Craig, 2004). The scoring system was based on the five core food groups as defined by the Australian Guide to Healthy Eating (AGHE) listed as:

- breads and cereals (including breakfast cereals, bread and rice);
- vegetables;
- fruit;
- dairy products (including soya milk products);
- meat and meat alternatives (including eggs, vegetarian meat alternatives and nuts).

The Diet Quality Index Revised (DQI-R) was used to assess the quality of the overall diet, and was applied to all meals of the day, including breakfast. The DQI-R utilises a 100-point scale for a number of different indices or components of both food and nutrient measures of diet quality (Haines, Siega-Riz, & Popkin, 1999).

Height and weight was measured by a level one anthropometrist using the International Society for the Advancement of Kinanthropometry (ISAK) standards.

Statistical analysis

A standardized coding system was applied to each variable. SPSS® statistical software package was used to analyse the data. Associations between breakfast intake and other categorical characteristics were assessed by either the Chi-square Test or Fisher's Exact Test. Spearman correlations were used to assess the associations between breakfast quality score and continuous variables. A p-value < 0.05 was indicative of statistical significance.

The Goldberg cut-off is an equation used to validate reported energy intake in individuals and populations (Black, 2000). It operates on the assumption that if a study

participant maintains a certain body weight, then Energy Intake (EI) must equal energy expended for that participant. The equation uses the Basal Metabolic Rate (BMR) and Physical Activity Level (PAL) relevant to the group being analysed to create acceptable variances for the ratio EI: BMR. If this ratio fell above or below calculated cut-off points, then that study participant was considered to be an under- or over-reporter and was removed from the data set to ensure data validity. The Goldberg cut-off was applied to exclude over- and under-reporters in this study (where $EI: BMR < 0.6$ or > 4.91). Appendix A shows the calculations for determining the Goldberg cut off points as defined by Black (2000).

Ethical considerations

The research proposal was approved by The Research Ethics Committee of the North-West University (NWU-00031-13-A1). The study protocol was compliant to guidelines outlined by the Medical Research Council general principles, and to the international guidelines listed as The Helsinki Declaration, The Belmont Report and The Nuremberg Code. In addition, the research protocol was approved by the Department of Education in Northwest Province, and permission to conduct this study was granted. Both written consent and assent were obtained from parents or guardians as well as adolescents before commencement of the study. Participants could withdraw from the study at any point.

Results

Data was collected for a total of 254 adolescents. Ten of the adolescents were found to be over- or under-reporters, and these adolescents were excluded from the final data set in order to avoid skewed data. The final data set consisted of data for 244 adolescents.

The mean age of the adolescents in the analysis sample was 17.5 years (± 2.3). Of the 244 study participants, 20 (8%) were aged 21 years or older. Although these participants are not classified as adolescents, they were not excluded from the study as the factors and behaviours to which these individuals are exposed are the same as for the adolescents included in the study sample. Of the analysis sample, 54% ($n = 131$) were girls and 46% ($n = 113$) were boys. Table 1 provides a summary of the demographic and anthropometric data for the adolescents participating in the study.

Table 1

Demographic and anthropometric characteristics of adolescents

	Total (n = 244)			Boys (n = 113)			Girls (n = 131)		
	Mean	SD	Median	Mean	SD	Median	Mean	SD	Median
Age (years)	17.5	2.3	17	17.6	2.6	17	17.4	1.9	17
BMI (kg/m ²)	21.7	4.2	20.5	21.1	4.1	20.0	22.3	4.3	21.3
Weight (kg)	58.8	13.0	56.3	60.8	14.5	57.4	57.0	11.4	54.7
Body Fat %	21.4	10.9	19.5	15.2	9.2	12.2	26.6	9.5	25.4
Total energy intake (kcal)	2340	933	2170	2563	953	2421	2148	874	2031
Diet Quality Score	58.2	9.9	57.8	58.1	10.1	57.6	58.3	9.4	58.9
Breakfast Quality Score	3.1	1.2	3	3.1	1.3	3	3.1	1.2	3

Anthropometric data was collected for 243 adolescents. Of the girls aged 14 to 20 years, 21% had a BMI-for-age below the 25th percentile, 34% had a BMI-for-age above the 75th percentile, and 45% had a BMI-for-age between the 25th and 75th percentiles. Of the boys aged 14 to 20 years, 47% had a BMI-for-age which fell below the 25th percentile, 18% had a BMI-for-age which fell above the 75th percentile, and 35% had a BMI-for-age which fell between the 75th and 25th percentiles. Of the study participants aged 21 to 26 years, 21% were underweight and 16% were overweight.

The prevalence of breakfast intake

Of the total group, 81% of the adolescents had eaten breakfast the day before data collection and 19% had skipped breakfast as shown by the 24-hour recall. The demographic factors associated with frequency of breakfast intake and skipping were analysed using Chi-Square tests and the results of this analysis are summarised in Tables 2a and 2b. Of the girls surveyed (n=131), 19.1% had skipped breakfast the day before data collection, compared to 18.6% of the boys surveyed (n=113). Of the girls surveyed, 80.9% had eaten breakfast the day before data collection, compared to 81.4% of boys who had eaten breakfast. There was no significant difference between the frequency of breakfast intake or skipping between genders ($p = 0.921$).

Table 2a

Breakfast intake by demographic characteristics (Chi-Square tests)

	Gender			Grade				Self-reported race		
	Female (n=131)	Male (n=113)	P- value	9 (n=74)	10 (n=75)	11 (n=95)	P-value	Black (n=197)	Other ^a (n=47)	P-value
Skipped breakfast (%)	19.1	18.6	0.921	17.6	22.7	16.8	0.593	21.8	6.4	0.013
Consumed breakfast (%)	80.9	81.4		82.4	77.3	83.2		78.2	93.6	

^a'Other' self-reported races were White, Indian, Coloured and Other.

Table 2b

Breakfast intake by demographic characteristics (Chi-Square tests)

	Tobacco use^a			Alcohol use^b			Participation in physical activity^c		
	Yes (n=211)	No (n=30)	P- value	Yes (n=228)	No (n=14)	P- value	Yes (n=168)	No (n=73)	P- value
Skipped breakfast (%)	18.5	23.3	0.527	17.1	50.0	0.271	17.3	21.9	0.394
Consumed breakfast (%)	81.5	76.7		82.9	50.0		82.7	78.1	

^aTwo breakfast eating cases did not indicate smoking status.^bOne breakfast eating case did not indicate alcohol consumption.^cTwo breakfast eating cases and one breakfast skipping case did not indicate participation in physical activity.

Breakfast quality score

The mean breakfast quality score for the study group was 3.1 (± 1.27), with a maximum possible score of 5 and a minimum possible score of 1. The breakfast quality score is based on the inclusion of food groups as defined by the AGHE. A higher score indicates foods from more AGHE groups were included at breakfast and indicates a better breakfast quality. Table 3 shows breakfast quality score for the study population. Breakfast quality scores of 4 and 3 were the most frequent, indicating a moderate breakfast quality (a food or beverage from one to two groups from the AGHE: breads and cereals, vegetables, fruit, dairy or meat and meat alternatives were eaten at breakfast).

Table 3

Components of the breakfast quality score

Breakfast Quality Score component	Scoring criteria	% study population	Total (n)
No food or beverage (other than water); breakfast skipping	1	20.1	49
A food or beverage from “extra” foods only ^a	2	7.0	17
A food or beverage from one AGHE group ^b	3	25.0	61
A food or beverage from two AGHE groups ^b	4	39.3	96
A food or beverage from three or more AGHE groups ^c	5	8.6	21

AGHE: Australian Guide to Healthy Eating.

^aConsidered to be a breakfast of low quality.^bConsidered to be a breakfast of moderate quality.^cConsidered to be of good breakfast quality.

The effect of breakfast intake and breakfast quality score on diet quality score and lifestyle behaviours

The mean diet quality score for the study group was 58.3 ($\pm$ 9.85) out of a total possible score of 100. Table 4 shows the breakdown of DQI-R components for adolescents who consumed and skipped breakfast on the day of data collection. The maximum possible score for each of the DQI-R components was 10. The components of the DQI-R which showed the lowest mean scores for the study sample were percentage of recommended servings of fruits per day (mean score 1.6), dietary diversity (mean score 2.5), percentage of adequate intake for calcium (mean score 3.2) and percentage of recommended servings of vegetables per day (mean score 3.5). The components which showed the highest mean scores were percentage of recommended servings for grains per day (mean score 9.5) and percentage of recommended daily allowance for iron (mean score 8.7).

Table 4

Components of the DQI-R by breakfast intake and skipping

DQI Component	Scoring criteria	Scoring %	Total group mean score (SD)	Mean diet quality score among adolescents who consumed breakfast	Mean diet quality score among adolescents who skipped breakfast
Total fat $\leq 30\%$ energy intake	$\leq 30\% = 10$	48.0%	7.4 (± 2.5)	7.4	7.2
	$>30, \leq 40\% = 5$	52.0%			
	$>40\% = 0$	0%			
Saturated fat $\leq 10\%$ energy intake	$\leq 10\% = 10$	63.5%	7.5 (± 3.6)	7.6	7.3
	$>10, \leq 13\% = 5$	23.4%			
	$>13\% = 0$	13.1%			
Dietary cholesterol < 300 mg per day	$\leq 300 = 10$	73.0%	7.7 (± 3.9)	7.6	8.4
	$>300, \leq 400 = 5$	9.0%			
	$>400 = 0$	18.0%			
2-4 servings fruit per day, ^{bc} % recommended servings	$\geq 100\%$	4.9%	1.6 (± 0.7)	1.7	1.2
	99-50%	14.3%			
	$< 50\%$	80.7%			
3-5 servings vegetables per day, ^{bc} % recommended servings	$\geq 100\%$	5.3%	3.5 (± 0.3)	3.3	3.9
	99-50%	24.2%			
	$< 50\%$	70.5%			
6-11 servings grains per day, ^{bc} % recommended servings	$\geq 100\%$	87.3%	9.5 (± 1.4)	9.5	9.6
	99-50%	11.1%			
	$< 50\%$	1.6%			
Calcium intake as a % AI ^d for age ^c	$\geq 100\%$	2.9%	3.2 (± 2.5)	3.4	2.3
	99-50%	18.9%			
	$< 50\%$	78.3%			

DQI Component	Scoring criteria	Scoring %	Total group mean score (SD)	Mean diet quality score among adolescents who consumed breakfast	Mean diet quality score among adolescents who skipped breakfast
Iron intake as a percentage 1989 RDA ^a for age	≥100%	59.0%	8.7 (±1.9)	8.9	7.9
	99-50%	34.4%			
	<50%	6.6%			
Dietary diversity score	≥6	0%	2.5 (±1.0)	2.6	2.1
	≥3, <6	26.2%			
	<3	73.8%			
Dietary moderation score	≥7	42.6%	6.6 (±1.6)	6.4	7.1
	≥4, <7	52.9%			
	<4	4.5%			
Total Diet Quality Score ^e			58.3 (±9.9)	59.0	57.0

^bBased on 1600, 2200 or 2800 kcal diet.

^cUsed as a continuous variable.

^dAI = adequate intake value.

^aRDA = recommended dietary allowance.

^eMaximum possible score = 100.

In this study, adolescents of Black race were seen to have lower breakfast intake ($p=0.013$) and lower breakfast quality score ($p=0.0001$) when compared to other races. Race was grouped as 'Black' or 'other' because there were too few adolescents from Coloured, Indian, White and other race groups. Adolescents participating in physical activity were significantly more likely to have a higher breakfast quality score ($p=0.007$). Breakfast intake and quality was not associated with age, grade, alcohol use, tobacco use, BMI or body fat percentage.

There was no significant difference in diet quality score between adolescents who consumed and skipped breakfast. No correlation between breakfast quality score and diet quality score was found. It was however observed that certain components of the DQI-R increased with an increase in breakfast quality score, although the strength of the correlations indicated a trend rather than a proportionate relationship (Table 5). The components of the DQI-R influenced by breakfast quality score were the percentage of adequate intake for calcium ($r=0.418$; $p<0.0001$), total diversity score ($r=0.369$; $p<0.0001$) and meat diversity score ($r=0.503$; $p<0.001$). Increased breakfast quality score also showed a trend for increased intake of certain nutrients, namely calcium ($r=0.418$; $p<0.0001$) and phosphorous ($r=0.378$; $p<0.0001$).

Table 5

Relationship between breakfast quality score, components of the DQI-R and nutrient intake measured by Spearman Correlations

Variable	Total group mean (SD)	P-value	Correlation coefficient
Calcium intake as a % AI ^d for age ^c	3.2 (±2.5)	<0.0001	0.418
Dietary diversity score	2.5 (±1.0)	<0.0001	0.369
Meat diversity score	0.8 (±0.4)	<0.0001	0.503
Total Diet Quality Score ^e	58.3 (±9.9)	0.5334	0.040
Calcium intake (mg)	447 (±442)	<0.0001	0.418
Phosphorous intake (mg)	1159 (±590)	<0.0001	0.378

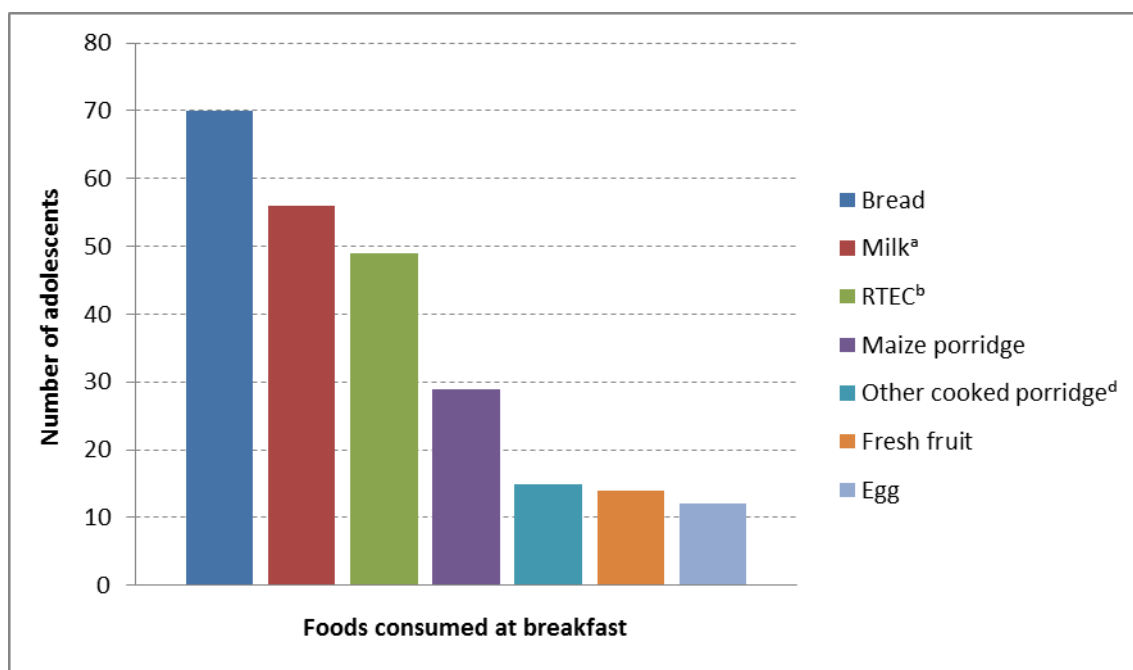
^cUsed as a continuous variable.

^dAI = adequate intake value.

^eMaximum possible score = 100.

Foods most frequently consumed for breakfast

In order to explain the trends observed in the diet quality score we investigated the most frequently consumed foods at breakfast. Bread, milk, ready-to-eat cereals (RTEC) and maize porridge were the most frequently consumed foods at breakfast as shown by Figure 1.



^aOnly included for servings of 100 ml or more.

^bRTEC: Ready-to-eat cereal.

^dMade up of cooked Maltabella (sorghum porridge) and cooked oats.

Figure 1

Frequency of intake for different foods at breakfast among adolescents

Added sugar was consumed by 140 of the adolescents at breakfast, and was consumed in an average serving size of 19 g. According to N. Temple and Steyn (2013), 10% of total energy is the upper limit for added sugar intake. It has been suggested that breakfast should contribute 25% of the day's energy and nutrient requirements (Gougeon, Henry, Ramdath, & Whiting, 2011; Institute of Medicine, 2006). The mean energy intake for the study population was 2340 kcal, indicating a maximum recommended added sugar intake of 57.5 g per day. Twenty-five percent of this guideline translates to 14.4 g of added sugar at breakfast. The mean sugar intake of 19 g among the adolescents at breakfast exceeds the added sugar allowance for this meal. Margarine was consumed by 42 of the adolescents at breakfast at an

average serving size of 14 g. It has been recommended that energy intake from fat should not exceed 30% of total energy intake for the day (Smuts & Wolmarans, 2013). For the present study population, 30% of the mean total energy consumed is equal to 77.2 g of fat. Twenty-five percent of this amount equals 19.3 g. The average serving of 14 g of margarine at breakfast falls within the acceptable fat intake range at breakfast. The beverages most frequently consumed at breakfast were tea (n = 74), water (n = 45) and coffee (n = 32).

The nutrient compositions of bread, milk, RTEC and maize are provided in Table 6 (Langenhoven, et al., 2002; Wolmarans, et al., 2010). Notably, the most frequent breakfast formats usually consumed as reported by self-administered questionnaires among the study group were “porridge only with a drink” (81%) followed by “bread, toast, roll or crisp bread with a drink” (77%).

Table 6

Nutrient compositions of foods commonly consumed at breakfast

Nutrient	Brown bread (fortified) (60 g serving)	Low fat milk (125 g serving)	RTEC ^a (Corn Flakes ^b) (40 g serving)	Maize meal (fortified, soft cooked) (250 g serving)
Energy	649 kJ	266 kJ	642 kJ	585 kJ
Protein	5.2 g	4.1 g	3.1 g	3.0 g
Carbohydrates	26.5 g	6.1 g	33.1 g	28.5 g
Sugar	0.0 g	6.1 g	2.5 g	0.0 g
Fat	1.2 g	2.5 g	0.1 g	0.8 g
Saturated fat	0.2 g	1.6 g	0.0 g	0.3 g
Cholesterol	0.0 mg	8.8 mg	0.0 mg	0.0 mg
Dietary fibre	4.0 g	0.0 g	1.3 g	1.3 g
Sodium	271 mg	58 mg	484 mg	0 mg
Thiamine	0.1 mg	0.0 mg	0.5 mg	0.1 mg

Nutrient	Brown bread (fortified) (60 g serving)	Low fat milk (125 g serving)	RTEC ^a (Corn Flakes ^b) (40 g serving)	Maize meal (fortified, soft cooked) (250 g serving)
Riboflavin	0.0 mg	0.2 mg	0.6 mg	0.0 mg
Niacin	1.6 mg	0.1 mg	7.1 mg	0.3 mg
Folic acid	25.2 ug	6.3 ug	100.0 ug	5.0 ug
Calcium	33.0 mg	152.5 mg	4.4 mg	0.0 mg
Iron	0.9 mg	0.1 mg	4.8 mg	0.3 mg
Phosphorous	104.4 mg	111.3 mg	20.4 mg	60.0 mg

^aRTEC: Ready-to-eat cereal.

^bCorn Flakes was the most frequently consumed ready-to-eat cereal among the study group.

Discussion

The main findings of this study were as follows: (1) 19% of adolescents skipped breakfast, (2) breakfast intake and quality did not significantly affect overall diet quality; and (3) intake of certain foods at breakfast may contribute valuable nutrients to the diet.

The present study found that 81% of adolescents ate breakfast and 19% skipped breakfast. When comparing this figure to international data, the prevalence of breakfast skipping appears to be moderate. International data indicates that breakfast skipping behaviour is as high as 79.7% among black adolescents in the US as reported by Delva, O'Malley, and Johnston (2006) to as low as 7% of adolescents in the UK as reported by Sandercock, Voss, and Dye (2010).

Research reporting breakfast behaviour among adolescents in South Africa is limited, although the South African National Health and Nutrition Examination Survey

(SANHANES) published in 2013 also indicated that 19% of children aged 10 to 14 years did not eat breakfast before going to school (Shisana, et al., 2013). Examined by province, the SANHANES reported that 22.9% of children in the Northwest province did not eat breakfast before school, and that children in the Western and Eastern Cape were significantly more likely to eat breakfast when compared to children in the Northwest, Gauteng and Limpopo provinces (Shisana, et al., 2013). N. J. Temple, et al. (2006) showed that 22% of adolescents attending secondary schools in Cape Town skipped breakfast, and similarly, Feeley, et al. (2012) showed the prevalence of breakfast skipping in Soweto, Gauteng to be 24%, 36% and 35% for adolescents aged 13, 15 and 17 years respectively. This suggests that the prevalence of breakfast intake among adolescents in South Africa differs by province, and possibly the environment to which adolescents are exposed. South Africa is undergoing a period of unique nutrition transition driven by aspects of economic globalisation such as urbanisation, changes in income and economic uplift, Westernisation of readily available foods, industry and marketing behaviour (K. Steyn, Fourie, & Temple, 2006; Stupar, et al., 2012). The nutrition transition is transforming the landscape of foods available to the public and may be influencing food and dietary choices among adolescents. According to Feeley, et al. (2012), breakfast skipping as well as other poor lifestyle habits, may be reflective of the context in which South African adolescents live. It has been noted that the observed behaviours may be as a result of complex interactions within demographics, the environment and economics (Feeley, et al., 2012; Popkin & Gordon-Larsen, 2004). It would be valuable to understand the drivers for breakfast skipping behaviour within different adolescent population groups in South Africa.

The mean breakfast quality score for this study group was 3.1, indicating a moderate breakfast quality, which includes food from only one of the AGHE food groups. It was hypothesised that prevalence of breakfast intake and breakfast quality score would

decrease with age in this study population. This research showed no relationship between age and breakfast intake or breakfast quality score.

The Integrated School Health Policy (ISHP) of South Africa is the first joint policy between the Department of Health and Basic Education, and focusses on identifying and managing health barriers to learning among children in state schools in South Africa (Department of Health & Department of Basic Education, 2012). The ISHP seeks to up-weight existing health programmes in state schools, and build a comprehensive and holistic health-promoting programme through cross-collaboration of governmental departments and key stakeholders within the teaching environment (Department of Health & Department of Basic Education, 2012). Nutrition has been highlighted as a key focus area within the ISHP and is being addressed in the following ways:

- Nutrition and exercise education has been included as part of the Life Orientation subject curriculum;
- Anthropometric measures for learners are being assessed to determine the risk for nutrition-related illnesses. Where nutrition illnesses are detected, effective intervention plans are implemented accordingly;
- Nutrition was identified as a key focus area in the Care and Support for Teaching and Learning Programme which focusses on delivery and expanding appropriate care to schools;
- Up-weighting of the Integrated Nutrition Program (INP) focussing on house-hold food security, health monitoring and promotion, control of micronutrient deficiencies, nutrition education and disease specific nutrition support and

- Up-weighting the National School Nutrition Programme (NSNP) which provides nutritious meals to learners in need.

The findings of the present study provide some insights into the implementation of the ISHP in the Northwest Province.

The South African Department of Basic Education has implemented the NSNP among lower income primary and secondary schools (Department of Basic Education, 2012). According to the policy, a nutritious meal should be served to learners by 10:00 am (Department of Basic Education, 2012). The schools in quintiles 1 to 4 included in this research all benefitted from the NSNP, where schools in quintile 5 did not. On further investigation, it was found that the NSNP meal was actually being served at 11 am, and was thus classified as a “morning snack” rather than “breakfast” for purposes of this research. Receiving this meal before 10 am would have improved the breakfast quality score among these adolescents, but since it was only received at 11 am, the NSNP meal only affected the diet quality score in these groups. Given the identified benefits of breakfast, and the prevalence of breakfast skipping among adolescents in the Northwest province, provision of a breakfast meal is important among this target group. There is therefore an opportunity to improve the NSNP meal delivery in these schools to ensure the meal is served before 10 am as per the policy requirements.

In this study, adolescents of black race had lower breakfast intake prevalence and a lower breakfast quality score when compared to other races. Similar findings have been observed in international research. Breuning, et al. (2011) summarised the predictors of breakfast consumption among adolescents in the US, and found that non-white groups were less likely to consume breakfast when compared to White groups. Delva, et al. (2006) reported that Black and Hispanic youth were less likely to consume breakfast regularly when compared to White youth in adolescents in the US. While

self-reported race alone cannot explain the differences observed in breakfast intake and quality, it is possible that cultural exposures within different race groups may influence breakfast eating behaviour. Further research is required to understand cultural attitudes and perceptions towards breakfast intake, potentially explaining the differences observed between different race groups.

Participation in physical activity was associated with improved breakfast quality. To our knowledge, no study has reported on the relationship between breakfast quality and physical activity, although a positive relationship for breakfast intake and increased physical activity has been observed (Keski-Rahkonen, Kaprio, Rissanen, Virkkunen, & Rose, 2003; Sandercock, et al., 2010; Schembre, et al., 2013; Tin, Ho, Mak, Wan, & Lam, 2011). In the present study, participation in physical activity did not differ between adolescents who consumed or skipped breakfast. This highlights the need to investigate the role of breakfast quality, as well as breakfast intake, in influencing subsequent activity levels for the day.

It has been suggested that breakfast skipping, along with lack of physical activity, alcohol consumption, smoking, and poor sleep behaviour, form a bundle of health compromising behaviours which predispose adolescents to poor health outcomes in the long term (Huang, Hu, Fan, Liao, & Tsai, 2010). Individuals who skip breakfast may be less concerned with their health than those who always eat breakfast (Keski-Rahkonen, et al., 2003). The present study found no relationship between alcohol use, smoking and breakfast intake. Until causality between breakfast intake and these health risk behaviours is established, it is recommended that health care professionals address each of these individual behaviours through a multidisciplinary approach, and continue to promote and protect breakfast intake among the adolescent population (Rampersaud, 2008).

It was hypothesised that breakfast intake and a higher breakfast quality score would result in a higher diet quality score for adolescents for the day. The present study found no significant difference in diet quality score between adolescents who consumed and skipped breakfast. No correlation between breakfast quality score and diet quality score was found. Breakfast quality score and components of the DQI-R were marginally associated, indicating a trend for improved calcium intake, dietary diversity score and meat diversity score. When comparing mean scores for components of the DQI-R (Table 6) between adolescents who ate and skipped breakfast, breakfast skippers had a lower (less favourable) mean score for calcium and iron intake, and a higher (more favourable) mean score for cholesterol intake.

When examining the foods most frequently consumed for breakfast, bread, milk and RTEC were the most prevalent foods. Nutrition analyses of these foods shows that they are valuable contributors of certain nutrients to the diet (Langenhoven, et al., 2002; Wolmarans, et al., 2010). Milk is a significant contributor of calcium to the diet (Dairy Council, 2011). The present study showed that adolescents who consumed breakfast were more likely to consume milk, thus explaining the trend observed for increased calcium intake among the breakfast eating group. The DQI-R component “meat diversity score”, classified milk as a “meat”, which meant that adolescents who ate breakfast and were more likely to have milk and in turn also have a slightly higher mean meat diversity score. The meat diversity score was one of the major contributors to the total diversity score. The consumption of milk among breakfast eaters therefore explains the trend between increased breakfast quality score, increased calcium intake, increased meat diversity score and total diversity score respectively. Of the most frequently consumed foods at breakfast, milk was the only contributor of cholesterol. Again, the consumption of milk among breakfast eaters may explain the tendency for higher cholesterol intake among breakfast eaters when compared to breakfast

skippers. In South Africa, it is mandatory to fortify all white and brown bread flour and maize meal with vitamin A, thiamine, riboflavin, niacin, folic acid, pyridoxine, iron and zinc (Department of Health, 2002). Consumption of these foods helps to increase intake of these nutrients which are lacking in the diets of many South Africans (N. Steyn, Wolmarans, Nel, & Bourne, 2008). Given that bread and maize were two of the most frequently consumed foods at breakfast, the iron content of these foods as part of the national fortification mandate may explain the tendency for higher iron intake among breakfast eaters when compared to breakfast skippers. RTEC is typically fortified with iron as well as other nutrients (McNulty, et al., 1996), and may also have contributed to the iron intake of the breakfast eating group. Brown bread, milk and maize meal also contain phosphorous, helping to explain the trend for increased phosphorous intake in the breakfast eating group (Wolmarans, et al., 2010).

The strength of this study was that the total number of participants included created adequate power to draw valid conclusions from the results of this research including determining accurate means and standard deviation and to be able to compare quintiles with each other. However, limitations should also be taken into account when interpreting these results. The cross-sectional study design allowed for understanding relationships and associations around breakfast intake and quality, but does not establish causality between these variables. The study participants were randomly selected from seven preselected schools representing five different quintile backgrounds. It is possible that the behaviour observed by quintile may be attributed to socio-environmental factors, including school culture and environment. While the present study observed some trends in breakfast behaviour among different adolescent groups, including more schools from each quintile would provide a better representation of socio-economic background. More specific questions including a qualitative assessment could also be used to address attitudes, behaviour, socio-

economic status and food security. Lastly, the breakfast intake behaviour was determined from one 24-hour recall and does not reflect usual breakfast intake.

Conclusion and implications for research and practise

The role of breakfast in improving nutrient intake and diet quality, as well as decreasing risk for obesity and chronic diseases in adolescents has been well documented in international research. This study shows that 19% of adolescents did not eat breakfast on the day of data collection, meaning these adolescents have missed an opportunity to improve their health outcomes.

The quality of the breakfast consumed among adolescents in the present study was moderate, highlighting an opportunity for intervention to improve breakfast intake and quality among this target group.

The findings of the current study suggest that cultural and socio-environmental factors may influence breakfast intake and breakfast quality, and further research is required to understand how different cultural and environmental factors, as well as individual attitudes and perceptions towards breakfast, influence breakfast behaviour among South African adolescents.

While breakfast intake did not influence diet quality among the adolescents, it was shown that the intake for certain foods at breakfast helps to improve the mean scores for components of the DQI-R and helps to improve the intake of key nutrients.

It is recommended that the governmental departments responsible for the ISHP incorporate breakfast messaging into the nutrition education component of the ISHP. Facilitators involved in implementing the ISHP, such as School-based support teams, teachers and healthcare professionals are encouraged to continue the promotion of

breakfast intake among adolescents, in order to entrench breakfast intake behaviour which will be continued into adulthood, improving health outcomes in the long-term.

Acknowledgements

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References

- Barton, B. A., Eldridge, A. L., Thompson, D., Affenito, S. G., Streigel-Moore, R. H., Franko, D. L., Albertson, A. M., & Crockett, S. J. (2005) . The relationship of breakfast and cereal consumption to nutrient intake and body mass index: The National Heart, Lung, and Blood Institute Growth and Health Study. *Journal of the American Dietetic Association*, 105.
- Black, A. (2000) . Critical evaluation of energy intake using the Goldberg cut-off for energy intake: basal metabolic rate. A practical guide to its calculation, use and limitations. *International Journal of Obesity*, 24, 1119-1130.
- Breuning, M., Larson, N., Story, M., Neumark-Sztainer, D., & Hannan, P. (2011) . Predictors of adolescent breakfast consumption: Longitudinal findings from project EAT. *Journal of Nutrition Education and Behaviour*, 43, 390-395.
- Cho, S., Dietrich, M., Brown, C., Clark, C., & Block, G. (2003) . The effect of breakfast type on total daily energy intake and body mass index: results from the Third National Health and Nutrition Examination Survey (NHANES III) . *Journal of the American College of Nutrition*, 22, 296-302.
- Dairy Council. (2011) . Dairy foods: a major nutrient contributor to Americans' diets. *Dairy Council Digest Archives*, 82.

- Delva, J., O'Malley, P. M., & Johnston, L. (2006) . Racial/Ethnic and Socioeconomic Status Differences in Overweight and Health-related Behaviours among American Students: National Trends 1986-2003. *Journal of Adolescent Health, 39*, 536-545.
- Department of Basic Education. (2012) . National school nutrition programme (NSNP) annual report. In D. o. B. Education (Ed.) . Pretoria, South Africa.
- Department of Health. (2002) . Regulations relating to the fortification of foodstuffs. Foodstuffs, cosmetics and disinfectants act, 1972. In *Act No. 54*.
- Department of Health, & Department of Basic Education. (2012) . Integrated School Health Policy. In.
- Deshmukh-Taskar, P. R., Nicklas, T. A., O'Neil, C. E., Keast, D. R., Radcliffe, J. D., & Cho, S. (2010) . The Relationship of Breakfast Skipping and Type of Breakfast Consumption with Nutrient Intake and Weight Status in Children and Adolescents: The National Health and Nutrition Examination Survey 1999-2006. *Journal of the American Dietetic Association, 110*, 869-878.
- Feeley, A., Musenge, E., Pettifor, J. M., & Norris, S. A. (2012) . Changes in dietary habits and eating practices in adolescents living in urban South Africa: The birth to twenty cohort. *Nutrition, 28*, e1-e6.
- Frech, A. (2012) . Healthy behaviour trajectories between adolescence and young childhood. *Advances in Life Course Research, 17*, 59-68.
- Gougeon, L., Henry, C., Ramdath, D., & Whiting, S. (2011) . Dietary analysis of randomly selected meals from the Child Hunger and Education Program School Nutrition Program in Saskatchewan, Canada, suggests that nutrient target levels are being provided. *Nutrition Research, 31*, 215-222.
- Haines, P. S., Siega-Riz, A. M., & Popkin, B. M. (1999) . The Diet Quality Index Revised: A measurement instrument for populations. *Journal of the American Dietetic Association, 99*, 697-704.
- Hall, K., & Giese, S. (2009) . Addressing quality through school fees and school funding. *South African Child Gauge, 2008/2009*, 35-40.
- Hoyland, A., Dye, L., & Lawton, C. L. (2009) . A systematic review of the effect of breakfast on the cognitive performance of children and adolescents. *Nutrition Research Reviews, 22*, 220-243.
- Huang, C., Hu, H., Fan, Y., Liao, Y., & Tsai, P. (2010) . Associations of breakfast skipping with obesity and health-related quality of life: evidence from a national survey in Taiwan. *International Journal of Obesity, 340*, 720-725.

- Institute of Medicine. (2006) . *Dietary reference intakes: the essential guide to nutrient requirements*. Washington, DC: The National Academies Press.
- Keski-Rahkonen, A., Kaprio, J., Rissanen, A., Virkkunen, M., & Rose, R. (2003) . Breakfast skipping and health compromising behaviours in adolescents and adults. *European Journal of Clinical Nutrition*, 57, 842-853.
- Kruger, H., Dhansay, M., Labadarios, D., Kotiah, M., & Kullman, L. (2002) . The importance of breakfast in meeting nutritional requirements of South African children. *South African Journal of Clinical Nutrition*, 15.
- Langenhoven, M., Conradie, P., Wolmarans, P., & Faber, M. (2002) . *Food quantities manual*. Parow Valley, Cape Town: Medical Research Council.
- McNulty, H., Eaton-Evans, J., Cran, G., Woulahan, G., Boreham, C., Savage, J., Fletcher, R., & Strain, J. (1996) . Nutrient intakes and impact of fortified breakfast cereals in schoolchildren. *Archives of Disease in Childhood*, 75, 474-481.
- Merten, M. J., Williams, A. L., & Shriver, L. H. (2009) . Breakfast Consumption in Adolescence and Young Adulthood: Parental Presence, Community Context, and Obesity. *Journal of the American Dietetic Association*, 109, 1384-1391.
- Niemeier, H. M., Raynor, H. A., Lloyd-Richardson, E. E., Rogers, M. L., & Wing, R. R. (2006) . Fast Food Consumption and Breakfast Skipping: Predictors of Weight Gain from Adolescence to Adulthood in a Nationally Representative Sample. *Journal of Adolescent Health*, 39, 842-849.
- Ortega, R. M., Requejo, A. M., Navia, B., Lopez-Sobaler, A. M., Quintas, M. E., Andres, P., Redondo, M. R., Lopez-Bonilla, M. D., & Rivas, T. (1998) . The relationship between the consumption of an inadequate breakfast and energy profile imbalance in preschool children. *Nutrition Research*, 18, 703-712.
- Popkin, B., & Gordon-Larsen, P. (2004) . The nutrition transition: worldwide obesity dynamics and their determinants. *International Journal of Obesity Related Metabolic Disorders*, 28, S2-S9.
- Radcliffe, B., Ogden, C., Coyne, T., & Craig, P. (2004) . Breakfast consumption patterns of upper primary schools students in 14 Queensland schools. *Nutrition and Dietetics: the Journal of the Dietitians Association of Australia*, 61, 151-158.
- Rampersaud, G. (2008) . Benefits of breakfast for children and adolescents: Update and recommendations for practitioners. *American Journal of Lifestyle Medicine*, 3, 86-103.

- Rampersaud, G., Pereira, M., Girard, B., Adams, J., & Metz, J. (2005) . Breakfast habits, nutritional status, body weight and academic performance in children and adolescents. *Journal of the American Dietetic Association*, 105, 743-760.
- Sandercock, G., Voss, C., & Dye, L. (2010) . Associations between habitual school-day breakfast consumption, body mass index, physical activity and cardiorespiratory fitness in English schoolchildren. *European Journal of Clinical Nutrition*, 64, 1086-1092.
- Schembre, S. M., Wen, C. K., Davis, J. N., Shen, E., Nguyen-Rodriguez, S. T., Belcher, B. R., Hsu, Y.-W., Weigensberg, M. J., Goran, M. I., & Spruijt-Metz, D. (2013) . Eating breakfast more frequently is cross-sectionally associated with greater physical activity and lower levels of adiposity in overweight Latina and African American girls. *American Journal of Clinical Nutrition*, 98, 275-281.
- Seiga-Riz, A. M., Popkin, B. M., & Carson, T. (2000) . Differences in food patterns at breakfast by sociodemographic characteristics among a nationally representative sample of adults in the United States. *Preventive Medicine*, 30, 415-424.
- Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., Reddy, P., Parker, W., Hoosain, E., Naidoo, P., Hongoro, C., Mchiza, Z., Steyn, N., Dwane, N., Makoae, M., Maluleke, T., Ramlagan, S., Zungu, N., Evans, M., Jacobs, L., Faber, M., & team, S.-. (2013) . *South African National Health and Nutrition Examination Survey (SANHANES-1)* . Cape Town: HSRC Press.
- Smith, K. J., Gall, S. L., McNaughton, S. A., Blizzard, L., Dwyer, T., & Venn, A. J. (2010) . Skipping breakfast: longitudinal associations with cardiometabolic risk factors in the Childhood Determinants of Adult Health Study. *American Journal of Clinical Nutrition*, 92, 1316-1325.
- Smuts, C., & Wolmarans, P. (2013) . The importance of the quality or type of fat in the diet: a food-based dietary guideline for South Africa. *South African Journal of Clinical Nutrition*, 26, S87-S99.
- Steyn, K., Fourie, J., & Temple, N. (2006) . Chronic Diseases of Lifestyle in South Africa: 1995 – 2005. In *Technical Report*. Cape Town: South African Medical Research Council.
- Steyn, N., Wolmarans, P., Nel, J., & Bourne, L. (2008) . National fortification of staple foods can make a significant contribution to micronutrient intake of South African adults. *Public Health Nutrition*, 11, 307-313.

- Stupar, D., Eide, W. B., Bourne, L., Hendricks, M., Iversen, P. O., & Wandel, M. (2012) . The nutrition transition and the human right to adequate food for adolescents in the Cape Town metropolitan area: Implications for nutrition policy. *Food Policy*, 37, 199-206.
- Temple, N., & Steyn, N. (2013) . Sugar and health: a food-based dietary guideline for South Africa. *South African Journal of Clinical Nutrition*, 26, S100-S104.
- Temple, N. J., Steyn, N. P., Myburgh, N. G., & Nel, J. H. (2006) . Food items consumed by students attending schools in different socioeconomic areas in Cape Town. *Nutrition*, 22, 252-258.
- Tin, S. P. P., Ho, S. Y., Mak, K. H., Wan, K. L., & Lam, T. H. (2011) . Lifestyle and socioeconomic correlates of breakfast skipping in Hong Kong primary 4 schoolchildren. *Preventive Medicine*, 52, 250-253.
- Walker, A., Walker, B., Jones, J., & Ncongwane, J. (1982) . Breakfast habits of adolescents in four South African populations. *American Journal of Clinical Nutrition*, 36, 650-656.
- Wolmarans, P., Danster, N., Dalton, A., Rossouw, K., & Schonfeldt, H. (2010) . *Condensed food composition tables for South Africa*. Parow Valley, Cape Town: Medical Research Council.

Chapter 4 – Conclusion and recommendations



The photograph above has been used with permission and shows the North-West University transport vehicle used during the data collection period.

4.1 Introduction

The primary objectives of the present study were 1) to determine the proportion of breakfast intake among adolescents attending public secondary schools in Potchefstroom and surrounding areas in the Northwest Province, 2) to assess the quality of the breakfast consumed, and 3) to determine the effect of breakfast intake and quality on overall diet quality for the day.

The secondary objectives for this research were 1) to determine socio-demographic factors associated with breakfast intake and quality and 2) to determine the effective of breakfast intake and quality on the adolescents' BMI.

By understanding the proportion of breakfast skipping and quality of breakfast consumed within a particular target group, research is able to create an understanding of the magnitude of the problem to be addressed. An understanding of how breakfast intake and quality influences diet quality and health outcomes will help to guide effective recommendations for breakfast intake which can be used in public health guidelines and intervention programs (Ortega *et al.*, 1998).

The purpose of this chapter is to summarise the conclusions of this research in light of the research hypotheses, and to provide recommendations for future studies investigating breakfast intake among adolescents in South Africa.

4.2 Main findings

It was hypothesised that the prevalence of breakfast skipping among adolescents attending public secondary schools in Potchefstroom and its surrounding areas would be approximately 20% based on the findings of the SANHANES and the review of breakfast intake data among children and adolescents in South Africa conducted by Kruger and co-workers (Kruger *et al.*, 2002; Shisana *et al.*, 2013). The present study found that 81% of adolescents consumed breakfast, and 19% skipped breakfast. The hypothesis for the prevalence of breakfast skipping was thus accepted.

The mean breakfast quality score of the study population was 3.1, indicating that one food from the AGHE core food groups was consumed at breakfast, providing a moderate breakfast quality. It was hypothesised that the mean breakfast quality score for the study population would reflect a poor quality breakfast. The hypothesis was therefore rejected. Foods most frequently consumed for breakfast were bread, milk, RTEC and maize porridge, all of which are components of one of the AGHE core food groups.

The present study found no significant difference in diet quality score between adolescents who consumed and skipped breakfast. No correlation between breakfast quality score and diet quality score was found. The hypothesis was thus rejected as it was hypothesised that breakfast intake and a higher breakfast quality score would result in a higher diet quality score for adolescents for the day.

Literature has shown various factors to influence breakfast intake among adolescents, including age, gender and race (Affenito *et al.*, 2005; Breuning *et al.*, 2011; Delva *et al.*, 2006; Hallstrom *et al.*, 2011). Age, gender, race, tobacco use, alcohol use and participation in physical activity were hypothesised to influence breakfast intake and quality. Adolescents of Black race were more likely to skip breakfast and have a lower diet quality score when compared to adolescents of other races. While self-reported race alone cannot explain the differences observed in breakfast intake and quality, it is possible that cultural exposures within different race groups may influence breakfast eating behaviour.

Physical activity participation was associated with a higher breakfast quality score. It has been suggested that breakfast skipping, along with lack of physical activity, alcohol consumption, smoking, and poor sleep behaviour, form a bundle of health compromising behaviours which predispose adolescents to poor health outcomes in the long term (Huang *et al.*, 2010). Individuals who skip breakfast may be less concerned with their health than those who always eat breakfast (Keski-Rahkonen *et al.*, 2003). Age, gender, tobacco use and alcohol use did not influence breakfast intake or quality. This hypothesis was thus partially accepted.

Breakfast quality score and components of the DQI-R were marginally associated, indicating a trend for improved calcium intake, phosphorous intake, dietary diversity score and meat diversity score. This finding was driven by the foods most frequently consumed at breakfast (bread, milk, RTEC, maize) being sources of calcium and phosphorous, and milk being classified as a “meat” increasing the meat diversity and dietary diversity scores.

It was hypothesised that Adolescents with higher breakfast intake and quality scores would have more favourable BMI. The findings of the present study showed no impact of breakfast intake or quality on BMI. The hypothesis was thus rejected.

Based on the findings of the present research, the following hypotheses were rejected:

- The mean breakfast quality score for the study population would reflect a poor quality breakfast and
- Breakfast intake and a higher breakfast quality score would result in a higher diet quality score for adolescents for the day.

- Adolescents with higher breakfast intake and quality scores would have more favourable BMI.

The following hypothesis was accepted:

- The prevalence of breakfast skipping among adolescents attending public secondary schools in the Kenneth Kaunda District would be approximately 20%.

Lastly, the following hypothesis was partially accepted:

- Age, gender, race, tobacco use, alcohol use and participation in physical activity were hypothesised to influence breakfast intake and quality.

4.3 Conclusions and recommendations

The role of breakfast in improving nutrient intake and diet quality, as well as decreasing risk for obesity and chronic diseases in adolescents has been well documented in international research. The present research indicated that breakfast skipping is prevalent among 19% of adolescents meaning these adolescents have missed an opportunity to improve their health outcomes. Breakfast intake and quality did not affect the diet quality score, but breakfast quality was marginally associated with components of the DQI-R.

The present study shared findings published by international research. Race was shown to influence breakfast intake as observed by Breuning *et al.* (2011) and Delva *et al.* (2006), and likelihood for participation in physical activity was seen to improve with improved breakfast intake (Keski-Rahkonen *et al.*, 2003; Sandercock *et al.*, 2010). However, the findings of the present study were not always consistent with international research. Breakfast intake and quality were not associated with diet quality, as found by (Grieger & Cobiac, 2012; Nicklas *et al.*, 2002; Tin *et al.*, 2011).

In view of the findings of the present study, and in line with evidence from previously published research, the following recommendations for future research are suggested, to better understand the intake of breakfast among adolescents in the South African context:

- Further research is required to understand how different cultural and environmental factors influence breakfast behaviour among South African adolescents. Having a tangible understanding of the cultural and environmental drivers for breakfast skipping will assist with the development of relevant and effective public intervention programs to improve breakfast intake among adolescents from different population groups in South Africa.

- Clinical intervention trials are required to determine causality between breakfast intake, improved diet quality and participation in physical activity, where breakfast intake would be the intervention.
- Further research is required to determine what the optimal breakfast type or quality entails, as it appears that breakfast quality does influence the beneficial outcomes observed with breakfast intake.

While research continues to seek clarity on the questions highlighted above, it is recommended that the governmental departments responsible for the ISHP incorporate breakfast messaging into the nutrition education component of the ISHP. Facilitators involved in implementing the ISHP, such as School-based support teams, teachers and healthcare professionals healthcare professionals are encouraged to continue the promotion of breakfast intake among adolescents, in order to entrench breakfast intake behaviour which will be continued into adulthood, improving health outcomes in the long-term.

4.4 My reflection of the research experience

Conducting this research project has helped to improve my understanding of the various factors influencing dietary behaviour. A complex matrix of interlinked and dynamic personal, environmental and macro-system factors ultimately guide dietary choices, and influencing these choices involves intervention at a very broad public health level.

During the process of this research, certain areas of invention to improve dietary intake of adolescents became apparent to me. These areas have been broadly discussed below, and may form the focus of future research projects or interventions.

- The 24-hour dietary recall data showed that many children from all quintile backgrounds were given some money to take to school for the purchase of foods at street vendors or tuck shops. The tuck shop purchases mainly included crisps and sugared popcorn. By influencing which types of foods are made available for purchase school tuck shops, one will be able to influence the nutrients contributed from tuck shop foods in the diets of these adolescents.
- Foods typically consumed from street vendors were “vetkoek”, “bunny chow” containing fried chips, viennas and egg or mince, and sometimes fresh whole fruits. Aside from the fruits which could be purchased from these vendors, the foods available were high energy and nutrient poor. Investigating ways of influencing the foods available for

purchase from these street vendors will help to minimise intake of empty calories among adolescents.

- On several occasions it was found that school teachers and coaches were giving nutrition advice to the adolescents, and this advice was not always sound. As key influencers during adolescence, teachers and coaches may be candidates for nutrition education programs which will help to ensure that accurate nutrition messages are communicated to adolescents.
- Poor nutrition knowledge among parents influences the dietary choices and foods made available to adolescents. By influencing parents' understanding of nutrition, the adolescents' exposure to different foods and behaviours may also be influenced.

I sincerely appreciate the opportunity I received with conducting this research which has given me a far more in-depth understanding of the constraints surrounding public health guidelines and recommendations.

4.5 References

- Affenito, S.G., Thompson, D.R., Barton, B.A., Franko, D.L., Daniels, S.R., Obarzanek, E., et al. 2005. Breakfast Consumption by African-American and White Adolescent Girls Correlates Positively with Calcium and Fiber Intake and Negatively with Body Mass Index. *Journal of the American Dietetic Association*, 105 (6) :938-945.
- Breuning, M., Larson, N., Story, M., Neumark-Sztainer, D. & Hannan, P. 2011. Predictors of adolescent breakfast consumption: Longitudinal findings from project EAT. *Journal of Nutrition Education and Behaviour*, 43 (5) :390-395.
- Delva, J., O'Malley, P.M. & Johnston, L. 2006. Racial/Ethnic and Socioeconomic Status Differences in Overweight and Health-related Behaviours among American Students: National Trends 1986-2003. *Journal of Adolescent Health*, 39:536-545.

Grieger, J. & Cobiac, L. 2012. Comparison of dietary intakes according to breakfast choice in Australian boys. *European Journal of Clinical Nutrition*, 66:667-672.

Hallstrom, L., Vereecken, C.A., Ruiz, J.R., Patterson, E., Gilbert, C.C., Catasta, G., et al. 2011. Breakfast habits and factors influencing food choices at breakfast in relation to socio-demographic and family factors among European adolescents. The HELENA Study. *Appetite*, 56:649-657.

Huang, C., Hu, H., Fan, Y., Liao, Y. & Tsai, P. 2010. Associations of breakfast skipping with obesity and health-related quality of life: evidence from a national survey in Taiwan. *International Journal of Obesity*, 340:720-725.

Keski-Rahkonen, A., Kaprio, J., Rissanen, A., Virkkunen, M. & Rose, R. 2003. Breakfast skipping and health compromising behaviours in adolescents and adults. *European Journal of Clinical Nutrition*, 57:842-853.

Kruger, H., Dhansay, M., Labadarios, D., Kotiah, M. & Kullman, L. 2002. The importance of breakfast in meeting nutritional requirements of South African children. *South African Journal of Clinical Nutrition*, 15 (1) .

Nicklas, T.A., McQuarrie, A., Fastnaught, C. & O'Neil, C.E. 2002. Efficiency of breakfast consumption patterns of ninth graders: Nutrient-to-cost comparisons. *Journal of the American Dietetic Association*, 102 (226-233) .

Ortega, R.M., Requejo, A.M., Navia, B., Lopez-Sobaler, A.M., Quintas, M.E., Andres, P., et al. 1998. The relationship between the consumption of an inadequate breakfast and energy profile imbalance in preschool children. *Nutrition Research*, 18 (4) :703-712.

Sandercock, G., Voss, C. & Dye, L. 2010. Associations between habitual school-day breakfast consumption, body mass index, physical activity and cardiorespiratory fitness in English schoolchildren. *European Journal of Clinical Nutrition*, 64:1086-1092.

Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., et al. 2013. South African National Health and Nutrition Examination Survey (SANHANES-1) . Cape Town: HSRC Press.

Tin, S.P.P., Ho, S.Y., Mak, K.H., Wan, K.L. & Lam, T.H. 2011. Lifestyle and socioeconomic correlates of breakfast skipping in Hong Kong primary 4 schoolchildren. *Preventive Medicine*, 52:250-253.

Addenda

Appendix A

Ethical approval from the NWU



NORTH-WEST UNIVERSITY
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10 June 2013

ETHICS APPROVAL OF PROJECT

☐ The North-West University Ethics Committee (NWU-EC) hereby approves your project as indicated below. This implies that the NWU-EC grants its permission that, provided the special conditions specified below are met and pending any other authorisation that may be necessary, the project may be initiated, using the ethics number below.

Project title: The intake and quality of breakfast consumption among adolescents attending public secondary schools in the North-West Province

Project Leader: Dr C Botha

Ethics	N	W	U	-	0	0	0	3	1	-	1	3	-	A	1
number:	STATUS: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation														

Approval date: 2013/06/10 **Expiry date:** 2018/06/09

Special conditions of the approval (if any): None

General conditions:
While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, please note the following:

- The project leader (principle investigator) must report in the prescribed format to the NWU-EC:
 - annually (or as otherwise requested) on the progress of the project,
 - without any delay in case of any adverse event (or any matter that interrupts sound ethical principles) during the course of the project.
- The approval applies strictly to the protocol as stipulated in the application form. Would any changes to the protocol be deemed necessary during the course of the project, the project leader must apply for approval of these changes at the NWU-EC. Would there be deviation from the project protocol without the necessary approval of such changes, the ethics approval is immediately and automatically forfeited.
- The date of approval indicates the first date that the project may be started. Would the project have to continue after the expiry date, a new application must be made to the NWU-EC and new approval received before or on the expiry date.
- In the interest of ethical responsibility the NWU-EC retains the right to:
 - request access to any information or data at any time during the course or after completion of the project;
 - withdraw or postpone approval if:
 - any unethical principles or practices of the project are revealed or suspected,
 - it becomes apparent that any relevant information was withheld from the NWU-EC or that information has been false or misrepresented,
 - the required annual report and reporting of adverse events was not done timely and accurately,
 - new institutional rules, national legislation or international conventions deem it necessary.

The Ethics Committee would like to remain at your service as scientist and researcher, and wishes you well with your project. Please do not hesitate to contact the Ethics Committee for any further enquiries or requests for assistance.

Yours sincerely



Prof Amanda Lourens
(chair NWU Ethics Committee)

Appendix B

Demographic questionnaire



NORTH-WEST UNIVERSITY
YUNIBESITHI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOM CAMPUS

The intake and quality of breakfast consumption among adolescents attending public secondary schools in Potchefstroom

Dear participant

Please note: We kindly ask that you complete this form as thoroughly as possible. You are welcome to take your time to complete the form. Your honest feedback in this questionnaire is of utmost importance.

Please be assured that all details provided in this questionnaire will remain completely confidential and will not be linked to you as an individual at any stage of the research project.

Demographic Information

Participant Number: _____	Date: _____
Study year (check one): ☐ Grade 9 ☐ Grade 10 ☐ Grade 11	
Race (check one): ☐ Black ☐ Coloured ☐ Indian ☐ White ☐ Other, please specify _____	
Where do you live? ☐ Flat ☐ House ☐ Town house ☐ Student house ☐ Hostel ☐ Informal housing ☐ Other, please specify _____	
How many people live with you? If you are in a hostel with how many people do you share a room? ☐ I live alone ☐ Give number of people _____	

Lifestyle information

Do you currently smoke or use tobacco? ☐ Yes ☐ No
If yes, please give more information: a) For how long have you been smoking/using tobacco? _____ b) How many cigarettes do/did you smoke per day? _____ c) How many times a day do/did you use tobacco (excluding cigarettes)? _____
Have you smoked in the past? ☐ Yes ☐ No
How long has it been since you've quit smoking? _____
Do you use alcohol? ☐ Yes ☐ No ☐ Sometimes

If yes / sometimes, please give more information regarding alcohol use:

How often do you use alcohol?

☐ Daily ☐ Weekly ☐ Monthly ☐ Yearly ☐ post event/game

What do you drink? _____

How much do you drink at a time? _____

CURRENT Sports and Physical Activity Participation

Are you currently physically active/ participating in any sport? ☐ YES ☐ NO

PHYSICAL ACTIVITY QUESTIONNAIRE

Activity at work/ campus

1. Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like (carrying heavy loads, digging or construction work) for at least 10 minutes continuously?

☐ YES ☐ NO (if no go to Q4)

2. In a typical week on how many days do you do vigorous intensity activities as part of your work/campus?

Number of days _____

3. How much time do you spend doing vigorous-intensity activities at work/campus on a typical day?

Hours: Minutes - _____ eg. 3 hrs 20 min

4. Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking (or carrying light loads) for at least 10 minutes continuously?

☐ YES ☐ NO (if no go to Q7)

5. In a typical week, on how many days do you do moderate intensity activities as part of your work?

Number of days _____

6. How much time do you spend doing moderate-intensity activities at work on a typical day?

Hours: Mins - _____ eg. 3 hrs 20 min

Travel to and from places

7. Do you walk or use a bicycle for at least 10 minutes continuously to get to and from places?

☐ YES ☐ NO (if no go to Q10)

8. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?

Number of days _____

9. How much time do you spend walking or bicycling for travel on a typical day?

Hours:Minutes - _____

Recreational Activities

10. Do you do any vigorous-intensity sports, fitness or recreational activities that cause large increases in breathing or heart rate like (running or football) for at least 10 minutes continuously?

☐ YES ☐ NO (if no go to Q13)

11. In a typical week, on how many days do you do vigorous intensity sports, fitness or recreational

(leisure) activities?

Number of days _____

12. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?

Hours: Minutes - _____ eg. 3hrs 20min

13. Do you do any moderate-intensity sports, fitness or recreational activities that causes a small increase in breathing or heart rate such as brisk walking (cycling, swimming, volleyball) for at least 10 min continuously?

☐ YES ☐ NO (if no go to Q16)

14. In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities?

Number of days _____

15. How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day?

Hours: Minutes - _____ eg. 3hrs 20min

Sedentary behaviour

16. How much time do you usually spend sitting or reclining on a typical day?

Hours: Minutes - _____ eg. 3hrs 20min

THANK YOU VERY MUCH FOR TAKING THE TIME TO FILL OUT THIS QUESTIONNAIRE
Please take a moment to fill in any questions you may have skipped.

Appendix C

Usual breakfast intake questionnaire



NORTH-WEST UNIVERSITY
YUNIBESITHI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOM CAMPUS

Breakfast intake of adolescents in Potchefstroom

Number: _____

Please give a description of your usual Breakfast intake:

1. Porridge only with a drink (Tea, coffee, etc)	
2. Porridge plus other cooked breakfast with drink	
3. Packet cereals only with drink	
4. Packet cereals plus other cooked breakfast with drink	
5 Cooked breakfast only with drink	
6. Only bread, toast, roll, crisp bread, etc., with drink	
7. Only fruit with or without drink	
8. NO breakfast – drink only	

Appendix D

24-hour recall form



NORTH-WEST UNIVERSITY
YUNIBESITHI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOM CAMPUS

The intake and quality of breakfast consumption among adolescents attending public secondary schools in Potchefstroom

24-HOUR RECALL

Subject number: _____

Interviewer: _____

Tick what the day was yesterday:

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
--------	--------	---------	-----------	----------	--------

Would you describe the food that you ate yesterday as typical of your habitual food intake?

Yes	1	No	2
-----	---	----	---

I want to find out about everything you ate or drank yesterday, including water or food you pick from the veld. Please tell me everything you ate from the time you woke up to the time you went to sleep. I will also ask you where you ate the food and how much you ate.

Time (approximately)	Place (Home, school, etc)	Description of food and preparation method	Amount	Amount in g (office use only)	Code (office use only)
From waking up to going to school, or starting day's activities					
During the morning at school or at home					

Time (approximately)	Place (Home, school, etc)	Description of food and preparation method	Amount	Amount in g (office use only)	Code (office use only)
Middle of the day (Lunch time)					
During the afternoon					
At night (dinner time)					
After dinner, before going to sleep					
Do you take any vitamins (tablets or syrup)?			Yes	1	No 2
Give the brand name and dose of the vitamin/tonic:					

Appendix E

Anthropometric measurements form



NORTH-WEST UNIVERSITY
YUNIBESITHI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOM CAMPUS

Anthropometric Measurements

Date: _____

Number: _____

Measurement	Measurement 1	Measurement 2	Measurement 3	Fieldworker
Height				
Weight				
Tricep				
Sub-scapular				

GUIDE FOR AUTHORS

Introduction

The Journal is an international, broadly based, cross-disciplinary, peer-reviewed journal addressing issues of professional and academic importance to people interested in adolescent development. The Journal aims to enhance theory, research and clinical practice in adolescence through the publication of papers concerned with the nature of adolescence, interventions to promote successful functioning during adolescence, and the management and treatment of disorders occurring during adolescence. We welcome relevant contributions from all disciplinary areas.

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