The extent and nature of food marketing to children in South African supermarkets

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“Use what talents you possess; the woods would be very silent if no birds sang there except those that sang best.”

-Henry Van Dyke

ABSTRACT

Background

Childhood overweight and obesity is on the rise in South Africa. If no obesity prevention strategies are implemented, South Africa could experience an overwhelming burden of obesity-related morbidities. Research shows that the food environment significantly affects the diet of children and that food marketing, specifically the packaging of foods, can influence children's food preferences and consumption of foods, leading to overweight and obesity. In response to this, the South African National Department of Health (SANDoH) published draft regulations (R.429 of 2014) that aim to regulate the marketing of unhealthy foods to children. However, limited information exists regarding the marketing of packaged foods to children in South African supermarkets. Therefore, the aim of this study was to investigate the extent and nature of marketing techniques on the packaging of child-orientated foods in South African supermarkets and to determine the healthiness of these foods.

Methods

Child-orientated packaged food and non-alcoholic beverages available in four South African supermarkets were identified, using a pre-defined criterion, and photographed. Photographs were then analysed and data regarding promotional characters, premium offers, claims, and nutritional information per 100 g were extracted. The foods were categorised according to the food group classification system of the Global Food Monitoring Group. The South African nutrient profiling model (SANPM) was used to classify foods to determine their healthiness. Descriptive statistics were used to determine the amount and type of marketing techniques on foods and to describe the use of these techniques on healthy versus unhealthy foods.

Results

A total of 477 foods were included in the study with most foods (61%) classified as unhealthy by the SANPM. The most common child-orientated foods were confectionaries (33%), cereal and cereal products (16%), dairy (13%) and non-alcoholic beverages (11%). There was a smaller proportion of foods from the fruit and vegetables category (2%) marketed to children. All three marketing techniques (promotional characters, premium offers, and claims) were used to market predominantly unhealthy foods to children. Promotional characters were present on 453 (95%) of foods with the majority being cartoon characters/company-owned characters (59.3%) and 'for kids'/child-associated promotional characters (34.5%). Claims were also present on 63.3% of the included foods of which 56.3% of all foods carrying a claim, were classified as unhealthy.

Conclusion

Most of the foods marketed to children in the included South African supermarkets were unhealthy and promotional characters and claims were the marketing techniques most often used to promote these foods. Our results suggest that the marketing of unhealthy foods in South African supermarkets do not support children to make healthy food choices. Therefore, the findings of this study support the need for marketing regulations in South Africa that will reduce the possible negative impact of unhealthy food marketing on children. Such regulations will support children by making healthy food choices easier.

Key terms: Food marketing; Children; Food packaging; Nutritional profile; South Africa; Premium offers; Promotional characters

DEFINITIONS

Child or children: Child between the ages of 1 and 18 years (WHO, 2016).

Child-orientated foods: a food of which the packaging contains two or more of the following (adapted from Elliott [2008:262]; Mehta *et al.* [2012:1764]):

- Pictures or cartoon images appealing to children.
- Specific or unusual shapes, colours, sizes or other iconography as well as the foregrounding or emphasis of any of these factors.
- Language, direct words or allusions referring to children, fun, play or school.
- Puzzles, games and premium offers, such as competitions, toys, giveaways, targeted at children.
- Cross-promotions or tie-ins with films, children's television programmes, celebrities, games, merchandise, websites and sports teams.
- Nutrient, health or health-related claims on the packaging.

Childhood obesity: For children younger than five years of age a weight-for-height greater than three standard deviations of the World Health Organization Growth Standards median. For children 5 to 18 years of age a body mass index-for-age greater than two standard deviations of the World Health Organizations Growth Reference median (WHO, 2021).

Childhood overweight: For children younger than five years of age a weight-for-height greater than two standard deviations of the World Health Organization Growth Standards median. For children 5 to 18 years of age a body mass index-for-age greater than one standard deviation of the World Health Organizations Growth Reference median (WHO, 2021).

Claim: Any representation on a food stating, suggesting or implying that the food has specific qualities related to its origin, nutritional properties, nature, processing, composition or any other quality (Codex Alimentarius Commission, 2018).

Food environment: The consumer interface with the food system that includes the availability, affordability, convenience, promotion and quality, and sustainability of foods and beverages and are influenced by the wider socio-cultural and political environment and ecosystems that surround them (Downs *et al.*, 2020:5).

Healthy food: Foods that help to create healthy diets when consumed in suitable amounts (WHO, 2016).

INFORMAS (International Network for Food and Obesity / non-communicable Diseases Research, Monitoring and Action Support): a global network of organisations and researchers that aims to monitor, benchmark and support public and private sector actions to create healthy food environments and reduce obesity and noncommunicable diseases (Rayner & Vandevijvere, 2017:56).

Label: A tag, brand, mark, pictorial or other descriptive matter that is on or attached to the food container (Codex Alimentarius Commission, 2018).

Labelling: A written, printed or graphic matter that is present on the label of a food, accompanies the food, or is displayed near the food, including matter that is used to promote the sale of the food (Codex Alimentarius Commission, 2018).

Marketing: Any form of communication or message intended to increase recognition, appeal and/or consumption of the specific product. In other words, everything used to advertise or promote the product (WHO, 2010).

Nutrient information panel (NIP): Information regarding the nutrient content of the seven mandatory nutrients (including energy, protein, fat, saturated fat, total carbohydrates, total sugar and sodium) declared on the food label and indicate the serving size of the food (Rayner & Vandevijvere, 2017:55).

Obesogenic environment: An environment that promotes high energy intake and sedentary behaviour (low energy expenditure) (WHO, 2016).

Unhealthy foods: Foods high in saturated fats, trans-fatty acids, free sugars or salt or sodium (also described as energy-dense, nutrient-poor foods) (WHO, 2016).

Ultra-processed food: Foods made from processed or refined substances (typically extracted from wholefoods through various industrial processes) that are usually hyper-palatable and energy-dense with low protein, fibre and micronutrient contents (Monteiro *et al.*, 2019:937).

ABBREVIATIONS

BMI: Body mass index

DBM: Double burden of malnutrition

EAR: Estimated average requirements

FAO: Food and Agriculture Organization

GDA: Guideline daily amount

GDP: Gross domestic product

HDL-C: High-density lipoprotein cholesterol

HFSS: High in fat, sugar and/or salt

INFORMAS: International Network for Food and Obesity / NCDs Research, Monitoring and Action Support

LMIC: Low- and middle-income country

NAFLD: Non-alcoholic fatty liver disease

NCD: Non-communicable diseases

NIP: Nutrition information panel

QUID: Quantitative ingredient declaration

SANDoH: South Africa National Department of Health

SANHANES: South African National Health and Nutrition Examination Survey

SANPM: South African nutrient profiling model

SDG: Sustainable development goals

UN: United Nations

UPF: Ultra-processed foods

WC: Waist circumference

WHO: World Health Organization

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CHAPTER 1 INTRODUCTION

1.1 Problem statement

In South Africa, childhood obesity is a growing epidemic that affects the health status of many children. Currently, children are exposed to a food environment that is not enabling them to develop and maintain a healthy lifestyle. The marketing of unhealthy foods, which are specifically targeting children, is a large contributing factor to the development of childhood obesity. Urgent action is required to manage the marketing of unhealthy foods targeting children. This study aims to gain knowledge of the marketing techniques of child-orientated foods in South African supermarkets in order to support the development of appropriate food and nutrition interventions.

1.2 Background and rationale

1.2.1 The double burden of malnutrition

The rise of childhood overweight and obesity (onward referred to as childhood obesity) is a public health concern that is contributing toward the global non-communicable disease (NCD) burden (NCD-RisC, 2017:2639). In 2020, an estimated 38.9 million (5.7%) children were affected by overweight globally (UNICEF *et al*., 2021). Childhood obesity increased markedly in South Africa (Lobstein & Jackson-Leach, 2016:323) and within Sub-Saharan Africa, South Africa is one of the countries with the highest prevalence of childhood obesity in boys and girls under 20 years of age (Ng *et al.*, 2014:774). Childhood obesity can greatly affect a child's wellbeing and quality of life during their lifespan. Overweight and obese children have a higher risk of developing a wide range of physical and psychological conditions including cardiometabolic risk factors, non-alcoholic fatty liver disease (NAFLD), asthma, depression, and a lower self-esteem (Rankin *et al.*, 2016:141; Sanders *et al.*, 2015:738; Skinner *et al.*, 2015:1310-1311). Childhood obesity is also a risk factor for developing NCDs during adulthood (Llewellyn *et al.*, 2015:17; Sommer & Twig, 2018:2-3).

Children in low- and middle-income countries (LMICs) who have already been exposed to different forms of undernutrition are now also facing overnutrition with its related health consequences (Caleyachetty *et al.*, 2018:421; L.B.D. Double Burden of Malnutrition Collaborators, 2020:756). South Africa is following suit with more children becoming overweight and some already presenting with NCD risk factors like hypertension, hypertriglyceridemia, and low high-density lipoprotein cholesterol (HDL-C) (Matjuda *et al.*, 2020:6; Negash *et al.*, 2017:3). While childhood obesity can place an extremely high

demand on the healthcare system of a country, it can also have further consequences on the economy of a country (Lehnert *et al.*, 2013:112). Because of the established health risks and consequences urgent action is needed to address the current childhood obesity pandemic. Childhood obesity and the co-morbidities related to it are largely preventable and therefore obesity prevention strategies should be prioritised.

Several countries have now implemented various strategies, guidelines, and/or targets to address the childhood obesity epidemic. The World Health Organization (WHO) Comprehensive Implementation Plan on Maternal, Infant and Young Child Nutrition and Global Action Plan for the Prevention and control of NCDs 2013-2020 include targets to halt the rise of obesity in children and adolescents by 2025 (WHO, 2013; WHO, 2014). Additionally, the Sustainable Development Goals (SDGs) include targets to end all forms of malnutrition by 2030 and to reduce premature death from NCDs by one third by 2030 (3.4) (UN, 2015). The urgency for countries to intervene was further emphasized by the United Nations (UN) General Assembly that proclaimed the UN Decade of Action on Nutrition 2016-2025 to prioritise, align and accelerate global nutrition actions that aim to eradicate malnutrition and reduce the burden of NCDs in order to meet the nutrition-related targets (WHO & FAO, 2018).

The food system is now recognised as the main driver of childhood obesity (Swinburn *et al.*, 2011:807). Since the food environment is where consumers interact with the food system (Downs *et al.*, 2020:5), many studies have subsequently explored the food environment as a possible setting for intervention. The food environment has become more obesogenic in nature, fuelling the overconsumption of unhealthy foods by children. Ultra-processed foods (UPFs), high in energy, fat, sugar and/or salt, have become increasingly available as a result of the globalisation of food systems (Baker *et al.*, 2020:6-7; Monteiro *et al.*, 2013:23) and are widely marketed within the food environment (Boyland & Whalen, 2015:333; Tatlow-Golden & Garde, 2020:9).

Food marketing is an area within the food environment that has been shown to increase the risk of obesity (Osei-Assibey *et al.*, 2012:10; Sonntag *et al.*, 2015:8570). Research shows that child-orientated food marketing is expanding, with most foods classified as unhealthy and unfamiliar to traditional diets (Cairns *et al.*, 2013:212; Elliott, 2019:4; Lavriša & Pravst, 2019:4; Signal *et al.*, 2017:6; Tatlow-Golden & Garde, 2020:2). Aside from changes in the food system, economic development, and rapid urbanization in LMICs resulted in many children being raised in these obesogenic environments (Baker *et al.*, 2020:10; Swinburn *et al.*, 2011:806).

Marketing of foods to children influence the dietary behaviour of children, including their attitude, perception, and consumption of food (Boyland *et al.*, 2016:519; Sadeghirad *et al.*, 2016:953; Smith *et al.*, 2019:5). There are many marketing mediums that companies use to attract and persuade children and their parents to purchase certain foods, such as television marketing, point of sale, free samples, gifts and tokens, packaging, loyalty schemes, tie-ins with licensed characters and programmes, sponsorship and in-school marketing (Cairns *et al.*, 2013:213). The packaging of foods also serves as a marketing medium at the point of sale and can influence food choices and eating behaviour (Chandon, 2013:8; Hallez *et al.*, 2020:11-12; Skaczkowski *et al.*, 2016:231). Food packaging is particularly powerful given that it is the medium that kids are most exposed to (Signal *et al.*, 2017:6).

Food labelling is a cost-effective tool that can help create healthier food environments (Gortmaker *et al.*, 2011:841). Food labels can empower consumers by informing them about the content of food, drawing attention to specific aspects of food (benefits, risks, etc.) and motivating the reformulation of foods that are classified as unhealthy (FAO, 2016). When used correctly, some components of food labels might therefore be able to assist children in making healthier food choices. For example, Dial and Musher-Eizenman (2020:5) found that children perceived fruits and vegetables with more information on the package (health information and cartoon characters) as tastier and healthier than fruits and vegetables with plain or no packaging.

Limited information regarding the marketing techniques on the packaging of child-orientated foods in South Africa and the healthiness of these foods, exists. Wiles (2017:13) examined ready-to-eat breakfast cereals that targeted children in South African supermarkets and found that the majority had a nutrient content claim, mostly relating to fibre and vitamins and minerals, and most child-orientated cereals have a poor nutritional profile due to higher amounts of carbohydrates, sugar and sodium. Wicks *et al.* (2017:2153) also found that 20% (125 out of 615) of foods advertisements on South African free-to-air television channels, aired during child-orientated programmes and that the most frequently advertised foods were from the high in fat, sugar and/or salt (HFSS) group, composite dishes, and sugar-sweetened beverages. Additionally, Mchiza *et al.* (2013:4) investigated television food advertisements aimed at children and adults and found that the majority of foods were considered unhealthy.

The effect that food marketing has on children comprises of more than immediate food choices. By fostering a deeper, emotional connection with children, marketers are promoting brand loyalty and building trust (Kraak & Story, 2015:16; Story & French, 2004:3) that further strengthens specific dietary habits that can be difficult to change.

Examining and understanding the external food environment can add value to childhood obesity strategies. In addition, limited research has been done on the food environment with regard to the marketing of foods to children in South Africa. Claasen *et al.* (2016:26) found that research about the relationship between the food industry, food environment and dietary behaviours of consumers within a South African context are lacking. Furthermore, they identified a need for more research to inform food and nutrition policies in South Africa.

Continuous exposure to a specific food environment will inevitably influence dietary behaviour and habits (Hawkes *et al.*, 2015:2411; Swinburn *et al.*, 2011:807-808) and thus the effect that the food environment has on individuals should not be underestimated. Developing interventions that focus on the food environment, allows for the intervention plan to reach a wider population that can lead to better success of obesity and NCD management. Moreover, it allows for the prevention of obesity, and not the treatment of obesity, to take priority.

The WHO published a Set of Recommendations on the Marketing of Food and Non-alcoholic Beverages to Children with the goal of reducing the exposure of children to the marketing of unhealthy foods and to create healthy environments (WHO, 2010). They mentioned that the first step should be to identify current information regarding the extent, nature and the effects of food marketed to children and to collect baseline data to use as a benchmark for policy evaluation. Since then, progress with regard to tackling the childhood obesity epidemic has been slow and as a result, the Commission on Ending Childhood Obesity was established in 2014 to review and build on existing childhood obesity strategies to support Member States. The Commission presented recommendations to Member States that denote the importance of addressing the obesogenic environment and regulating the marketing of food to children by implementing the WHO's set of recommendations and addressing food labelling to support healthier choices (WHO, 2016). Additionally, the Commission called for leadership from governments and for all stakeholders to recognise their responsibility to advocate for children.

South Africa has started with the process to implement restrictions on the marketing of foods to children. In 2014 the South African National Department of Health (SANDoH), Directorate: Food Control, published a draft regulation (R.429) relating to the Labelling and Advertising of Foods to children for comments (Department of Health, 2014a:90). The draft guidelines accompanying the regulations dictate that no energy-dense, nutrient-poor food (calculated by a nutrient profiling model that determine the healthiness of foods) are allowed to be marketed to children in any way (Department of Health, 2014b:75). Unfortunately, to date

these regulations have not been promulgated. Moreover, the Strategy for the Prevention and Control of Obesity in South Africa set the target to achieve a 10% reduction in the prevalence of obesity by 2020 and includes the goal to “create an enabling environment that supports the availability and accessibility of healthy food choices in various settings” (Department of Health, 2015:17). The strategy outlines the need to ensure that companies market food in an ethical and responsible way.

To our knowledge, research in South Africa regarding the different techniques used by the food industry to target children through food packaging is lacking. Information regarding the types of foods targeting children or marketed to children and the healthiness of these foods are also limited. To effectively inform food policies and change the food environment that children in South Africa are currently facing, appropriate research is needed to understand current food marketing practices. Therefore, it is necessary and relevant to investigate child-orientated food marketing within South African supermarkets.

1.3 Aim and Objectives

For the purpose of this study the extent and nature of food marketing to children will be interpreted as follows:

- Extent of food marketing to children: The reach and frequency of the marketing message (WHO, 2012). The reach describes the amount of marketing messages that people within the target market are exposed to.
- Nature of food marketing to children: Refers to the promotional channels used, type of foods promoted, and the creative strategies used to market food to children in supermarkets (Cairns *et al.*, 2013:210; WHO, 2012).
- Marketing: The marketing of packaged foods in a supermarket will be interpreted according to the Codex Alimentarius Commission (Codex) for food labelling as “any written, printed or graphic matter that is present on the label, accompanies the food, or is displayed near the food, including that for the purpose of promoting its sale or disposal” (Codex Alimentarius Commission, 2018).
- Child or children: People under 18 years of age (WHO, 2016). For the purpose of excluding complimentary foods, infants (below 12 months) will be excluded.

1.3.1 Aim

To investigate the extent and nature of food marketing to children in South African supermarkets.

1.3.2 Objectives

- To identify packaged foods aimed at children in South African supermarkets.
- To describe the various marketing techniques used by the identified packaged foods in South African supermarkets.
- To classify the healthiness of the identified foods according to the published (Wicks *et al.*, 2017:2152) South African nutrient profiling model.
- To compare the number of promotional characters, premium offers and claims on healthier versus unhealthy foods.

1.4 Ethical approval

Ethical approval was obtained from the North-West University Health Research Ethics Committee (NWU-00972-19-A1).

1.5 Structure of dissertation

This mini dissertation consists of four chapters.

Chapter one is an introduction to the study that describes the childhood obesity problem, the impact that marketing has on children and the rationale for the study. Additionally, the chapter also states the aim and objectives of the study and the research team and their roles.

Chapter two consists of a literature review that gives an overview of childhood obesity from both a global and South African perspective. The chapter further discusses the available literature regarding the food system, the food environment and marketing practices that target children and contribute towards obesity. Moreover, the packaging of foods is also discussed in terms of marketing.

Chapter three consists of a manuscript with the title: “The extent and nature of food marketing to children in South African supermarkets” that is prepared for publishing in the Public Health Nutrition journal.

Finally, **chapter four** contains the conclusion of the study as well as further recommendations.

1.6 Research Team

Table 1-1 outlines the research team. All team members are affiliated with the NWU and are registered with the Health Professions Council of South Africa (HPCSA).

Table 1-1: Research team and their role and responsibilities in the study

Partner name	Team member	Qualification, knowledge, experience, skills	Professional registration	Role and responsibility
North-West University	Marésa Gilfillan	• BSc Dietetics	HPCSA as a dietitian	• MSc student • Planning and execution of study, including data collection. • Statistical analysis and writing of manuscripts for publication and dissertation.
North-West University	Dr Mariaan Wicks	• PhD Dietetics • Nutrient profiling • Obesity prevention strategies. • Food marketing and labelling.	HPCSA as a dietitian	• Principal investigator • Supervisor for MSc student.
North-West University	Prof Edelweiss Wentzel-Viljoen	• PhD Dietetics • Dietary methodology • Food composition data. • Policy development, monitoring and evaluation.	HPCSA as a dietitian and nutritionist	• Guidance and critical review of the study.

BIBLIOGRAPHY

Baker, P., Machado, P., Santos, T., Sievert, K., Backholer, K., Hadjikakou, M., ... Scrinis, G. 2020. Ultra-processed foods and the nutrition transition: Global, regional and national trends, food systems transformations and political economy drivers. *Obesity Reviews*, 21(12):e13126. https://doi-org.nwulib.nwu.ac.za/10.1111/obr.13126

Boyland, E.J. & Whalen, R. 2015. Food advertising to children and its effects on diet: review of recent prevalence and impact data. *Pediatric Diabetes*, 16(5):331-337. https://doi.org/10.1111/pedi.12278

Boyland, E.J., Nolan, S., Kelly, B., Tudur-Smith, C., Jones, A., Halford, J.C.G. & Robinson, E. 2016. Advertising as a cue to consume: a systematic review and meta-analysis of the effects of acute exposure to unhealthy food and nonalcoholic beverage advertising on intake in children and adults. *American Journal of Clinical Nutrition*, 103(2):519-533. https://doi-org.nwulib.nwu.ac.za/10.3945/ajcn.115.120022

Cairns, G., Angus, K., Hastings, G. & Caraher, M. 2013. Systematic reviews of the evidence on the nature, extent and effects of food marketing to children. A retrospective summary. *Appetite*, 62:209-215. https://doi.org/10.1016/j.appet.2012.04.017

Caleyachetty, R., Thomas, G., Kengne, A.P., Echouffo-Tcheugui, J.B., Schilsky, S., Khodabocus, J. & Uauy, R. 2018. The double burden of malnutrition among adolescents: analysis of data from the Global School-Based Student Health and Health Behavior in School-Aged Children surveys in 57 low- and middle-income countries. *American Journal of Clinical Nutrition*, 108(2):414-424. https://doi-org.nwulib.nwu.ac.za/10.1093/ajcn/nqy105

Chandon, P. 2013. How package design and packaged-based marketing claims lead to overeating. *Applied Economic Perspectives and Policy*, 35(1):7-31. https://doi.org/10.1093/aepp/pps028

Claasen, N., Van Der Hoeven, M. & Covic, N. 2016. *Food environments, health and nutrition in South Africa, Working Paper 34*. Cape Town: PLAAS, UWC and Centre of Excellence on Food Security.

Codex Alimentarius Commission. 2018. *General standard for the labelling of prepackaged foods.* https://www.fao.org/fao-who-codexalimentarius/sh-

proxy/es/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXS%2B1-1985%252FCXS_001e.pdf Date of access: 15 September 2019.

Department of Health (South Africa). 2014a. *Draft guidelines applicable to the draft regulations relating to the labelling and advertising of foods (R.429 of 29 May 2014), for compliance purposes*. http://www.health.gov.za/index.php/shortcodes/2015-03-29-10-42-47/2015-04-30-09-10-23/2015-04-30-09-11-35/category/36-documents-for-comment Date of access: 13 October 2019.

Department of Health (South Africa). 2014b. *Foodstuffs, cosmetics and disinfectants act, 1972 (No.54 of 1972): Regulations relating to the labelling and advertising of foods: amendment. (Notice R.429).* http://www.gpwonline.co.za/Gazettes/Gazettes/37695_29-5_Health.pdf Date of access: 8 February 2019.

Department of Health (South Africa). 2015. *Strategy for the prevention and control of obesity in South Africa 2015-2020*. https://www.knowledgehub.org.za/elibrary/national-strategy-prevention-and-control-obesity Date of access: 6 February 2019.

Dial, L.A. & Musher-Eizenman, D.R. 2020. Power of packaging: Evaluations of packaged fruits and vegetables by school-age children in the US. *Appetite*, 148, 104591. https://doi.org/10.1016/j.appet.2020.104591

Downs, S.M., Ahmed, S., Fanzo, J. & Herforth, A. 2020. Food environment typology: advancing an expanded definition, framework, and methodological approach for improved characterization of wild, cultivated, and built food environments toward sustainable diets. *Foods*, 9(4), 532. https://doi.org/10.3390/foods9040532

Elliott, C. 2008. Assessing 'fun foods': nutritional content and analysis of supermarket foods targeted at children. *Obesity Reviews*, 9(4):368-377. https://doi-org.nwulib.nwu.ac.za/10.1111/j.1467-789X.2007.00418.x

Elliott, C. 2019. Tracking kids' food: comparing the nutritional value and marketing appeals of child-targeted supermarket products over time. *Nutrients*, 11(8), 1850. https://doi.org/10.3390/nu11081850

FAO (Food and Agriculture Organization of the United Nations). 2016. *Influencing food environments for healthy diets*. https://cgspace.cgiar.org/bitstream/handle/10568/80578/InfluencingFoodEnvironmentsForHealthyDiets.pdf?sequence=2&isAllowed=y Date of access: 2 November 2021.

Gortmaker, S.L., Swinburn, B.A., Levy, D., Carter, R., Mabry, P.L., Finegood, D.T., ... Moodie, M.L. 2011. Changing the future of obesity: science, policy, and action. *Lancet*, 378(9793):838-847. https://doi.org/10.1016/S0140-6736(11)60815-5

Hallez, L., Qutteina, Y., Raedschelders, M., Boen, F. & Smits, T. 2020. That's my cue to eat: A systematic review of the persuasiveness of front-of-pack cues on food packages for children vs. adults. *Nutrients*, 12(4), 1062. https://doi.org/10.3390/nu12041062

Hawkes, C., Smith, T.G., Jewell, J., Wardle, J., Hammond, R.A., Friel, S., ... Kain, J. 2015. Smart food policies for obesity prevention. *Lancet*, 385(9985):2410-2421. https://doi.org/10.1016/S0140-6736(14)61745-1

Kraak, V.I. & Story, M. 2015. Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs. *Obesity Reviews*, 16(2):107-126. https://doi.org/10.1111/obr.12237

L.B.D. Double Burden of Malnutrition Collaborators. 2020. Mapping local patterns of childhood overweight and wasting in low- and middle-income countries between 2000 and 2017. *Nature Medicine*, 26(5):750-759. https://doi.org/10.1038/s41591-020-0807-6

Lavriša, Ž. & Pravst, I. 2019. Marketing of foods to children through food packaging is almost exclusively linked to unhealthy foods. *Nutrients*, 11(5), 1128. https://doi.org/10.3390/nu11051128

Lehnert, T., Sonntag, D., Konnopka, A., Riedel-Heller, S. & König, H.-H. 2013. Economic costs of overweight and obesity. *Best Practice & Research Clinical Endocrinology & Metabolism*, 27(2):105-115. https://doi.org/10.1016/j.beem.2013.01.002

Llewellyn, A., Simmonds, M., Owen, C.G. & Woolacott, N. 2015. Childhood obesity as a predictor of morbidity in adulthood: a systematic review and meta-analysis. *Obesity Reviews*, 17(1):56-67. https://doi.org/10.1111/obr.12316

Lobstein, T. & Jackson-Leach, R. 2016. Planning for the worst: estimates of obesity and comorbidities in school-age children in 2025. *Pediatric Obesity*, 11(5):321-325. https://doi.org/10.1111/ijpo.12185

Matjuda, E.N., Engwa, G.A., Letswalo, P.B., Mungamba, M.M., Sewani-Rusike, C.R. & Nkeh-Chungag, B.N. 2020. Association of Hypertension and Obesity with Risk Factors of Cardiovascular Diseases in Children Aged 6-9 Years Old in the Eastern Cape Province of South Africa. *Children*, 7(4), 25. https://doi.org/10.3390/children7040025

Mchiza, Z.J., Temple, N.J., Steyn, N.P., Abrahams, Z. & Clayford, M. 2013. Content analysis of television food advertisements aimed at adults and children in South Africa. *Public Health Nutrition*, 16(12):2213-2220. https://doi.org/10.1017/S136898001300205X

Mehta, K., Phillips, C., Ward, P., Coveney, J., Handsley, E. & Carter, P. 2012. Marketing foods to children through product packaging: prolific, unhealthy and misleading. *Public Health Nutrition*, 15(9):1763-1770. https://doi.org/10.1017/S1368980012001231

Monteiro, C.A., Moubarac, J.C., Cannon, G., Ng, S.W. & Popkin, B. 2013. Ultra-processed products are becoming dominant in the global food system. *Obesity Reviews*, 14(S2):21-28. https://doi.org/10.1111/obr.12107

Monteiro, C.A., Cannon, G., Levy, R.B., Moubarac, J.-C., Louzada, M.L., Rauber, F., ... Martinez-Steele, E. 2019. Ultra-processed foods: what they are and how to identify them. *Public Health Nutrition*, 22(5):936-941. https://doi.org/10.1017/S1368980018003762

NCD-RisC (NCD Risk Factor Collaboration). 2017. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. *Lancet* 390(10113):2627-2642. https://doi.org/10.1016/S0140-6736(17)32129-3

Negash, S., Agyemang, C., Matsha, T.E., Peer, N., Erasmus, R.T. & Kengne, A.P. 2017. Differential prevalence and associations of overweight and obesity by gender and population group among school learners in South Africa: a cross-sectional study. *BMC Obesity*, 4(1), 29. https://doi.org/10.1186/s40608-017-0165-1

Ng, M., Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., ... Gakidou, E. 2014. Global, regional, and national prevalence of overweight and obesity in children and

adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*, 384(9945):766-781. https://doi.org/10.1016/S0140-6736(14)60460-8

Osei-Assibey, G., Dick, S., Macdiarmid, J., Semple, S., Reilly, J.J., Ellaway, A., ... McNeill, G. 2012. The influence of the food environment on overweight and obesity in young children: a systematic review. *BMJ Open*, 2(6), e001538. http://dx.doi.org/10.1136/bmjopen-2012-001538

Rankin, J., Matthews, L., Cobley, S., Han, A., Sanders, R., Wiltshire, H.D. & Baker, J.S. 2016. Psychological consequences of childhood obesity: psychiatric comorbidity and prevention. *Adolescent Health, Medicine and Therapeutics*, 7:125-146. https://doi.org/10.2147/AHMT.S101631

Rayner, M. & Vandevijvere, S. 2017. *INFORMAS Protocol: Food Labelling Module*. https://auckland.figshare.com/articles/INFORMAS_Protocol_Food_Labelling_Module/5673643 Date of access: 29 July 2019.

Sadeghirad, B., Duhaney, T., Motaghipisheh, S., Campbell, N.R.C. & Johnston, B.C. 2016. Influence of unhealthy food and beverage marketing on children's dietary intake and preference: a systematic review and meta-analysis of randomized trials. *Obesity Reviews*, 17(10):945-959. https://doi-org.nwulib.nwu.ac.za/10.1111/obr.12445

Sanders, R.H., Han, A., Baker, J.S. & Cobley, S. 2015. Childhood obesity and its physical and psychological co-morbidities: a systematic review of Australian children and adolescents. *European Journal of Pediatrics*, 174(6):715-746. https://doi.org/10.1007/s00431-015-2551-3

Signal, L.N., Stanley, J., Smith, M., Barr, M.B., Chambers, T.J., Zhou, J., ... Ni Mhurchu, C. 2017. Children's everyday exposure to food marketing: an objective analysis using wearable cameras. *International Journal of Behavioral Nutrition and Physical Activity*, 14, 137. https://doi.org/10.1186/s12966-017-0570-3

Skaczkowski, G., Durkin, S., Kashima, Y. & Wakefield, M. 2016. The effect of packaging, branding and labeling on the experience of unhealthy food and drink: A review. *Appetite*, 99:219-234. https://doi.org/10.1016/j.appet.2016.01.022

Skinner, A.C., Perrin, E.M., Moss, L.A. & Skelton, J.A. 2015. Cardiometabolic risks and severity of obesity in children and young adults. *New England Journal of Medicine*, 373(14):1307-1317. https://doi.org/10.1056/nejmoa1502821

Smith, R., Kelly, B., Yeatman, H. & Boyland, E. 2019. Food Marketing Influences Children's Attitudes, Preferences and Consumption: A Systematic Critical Review. *Nutrients*, 11(4), 875. https://doi.org/10.3390/nu11040875

Sommer, A. & Twig, G. 2018. The Impact of Childhood and Adolescent Obesity on Cardiovascular Risk in Adulthood: a Systematic Review. *Current Diabetes Reports*, 18(10), 91. https://doi.org/10.1007/s11892-018-1062-9

Sonntag, D., Schneider, S., Mdege, N., Ali, S. & Schmidt, B. 2015. Beyond Food Promotion: A Systematic Review on the Influence of the Food Industry on Obesity-Related Dietary Behaviour among Children. *Nutrients*, 7(10):8565-8576. 5414. https://doi.org/10.3390/nu7105414

Story, M. & French, S. 2004. Food advertising and marketing directed at children and adolescents in the US. *International Journal of Behavioral Nutrition and Physical Activity*, 1(3):1-17. https://doi.org/10.1186/1479-5868-1-3

Swinburn, B.A., Sacks, G., Hall, K.D., McPherson, K., Finegood, D.T., Moodie, M.L. & Gortmaker, S.L. 2011. The global obesity pandemic: shaped by global drivers and local environments. *Lancet*, 378(9793):804-814. https://doi.org/10.1016/S0140-6736(11)60813-1

Tatlow-Golden, M. & Garde, A. 2020. Digital food marketing to children: Exploitation, surveillance and rights violations. *Global Food Security*, 27, 100423. https://doi.org/10.1016/j.gfs.2020.100423

UN (United Nations). 2015. *Transforming our World: The 2030 Agenda for Sustainable Development*. https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf Date of access: 25 October 2021.

UNICEF (United Nations Children's Fund), WHO (World Health Organization) & World Bank Group. 2021. *Levels and trends in child malnutrition: key findings of the 2021 edition of the*

joint child malnutrition estimates. https://apps.who.int/iris/handle/10665/341135 Date of access: 15 September 2021.

WHO (World Health Organization). 2010. *Set of recommendations on the marketing of foods and non-alcoholic beverages to children*. http://apps.who.int/iris/bitstream/handle/10665/44416/9789241500210_eng.pdf?sequence=1 Date of access: 24 June 2018.

WHO (World Health Organization). 2012. *A framework for implementing the set of recommendations on the marketing of foods and non-alcoholic beverages to children.* https://apps.who.int/iris/bitstream/handle/10665/80148/9789241503242_eng.pdf?sequence=1&isAllowed=y Date of access: 12 October 2019.

WHO (World Health Organization). 2013. *Global action plan for the prevention and control of noncommunicable diseases 2013-2020*. http://apps.who.int/iris/bitstream/handle/10665/94384/9789241506236_eng.pdf?sequence=1 Date of access: 8 June 2018.

WHO (World Health Organization). 2014. *Comprehensive implementation plan on maternal, infant and young child nutrition*. http://apps.who.int/iris/bitstream/handle/10665/113048/WHO_NMH_NHD_14.1_eng.pdf?ua=1 Date of access: 8 June 2018.

WHO (World Health Organization). 2016. *Report of the Commission on Ending Childhood Obesity*. http://apps.who.int/iris/bitstream/handle/10665/204176/9789241510066_eng.pdf Date of access: 12 October 2019.

WHO (World Health Organization). 2021. *Obesity and overweight*. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight Date of access: 20 November 2021.

WHO (World Health Organization) & FAO (Food and Agriculture Organization of the United Nations). 2018. *Driving commitment for nutrition within the UN Decade of Action on Nutrition*. https://apps.who.int/iris/bitstream/handle/10665/274375/WHO-NMH-NHD-17.11-eng.pdf Date of access: 25 October 2021.

Wicks, M., Wright, H. & Wentzel-Viljoen, E. 2017. Restricting the marketing of foods and non-alcoholic beverages to children in South Africa: are all nutrient profiling models the

same? *British Journal of Nutrition*, 116(12):2150-2159. https://doi.org/10.1017/S0007114516004244

Wiles, N.L. 2017. The nutritional quality of South African ready-to-eat breakfast cereals. *South African Journal of Clinical Nutrition*, 30(4):8-16. https://doi.org/10.1080/16070658.2017.1319124

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

The childhood obesity epidemic is compromising the immediate and long-term wellbeing of children and contributing to the global burden of non-communicable diseases (NCDs). Numerous studies have established the food industry as the key driver in creating obesogenic food environments for children. The availability of cheap, unhealthy foods that are heavily marketed towards children can adversely influence their food intake. The packaging of foods contributes significantly toward the food choices that children make and can increase their risk of becoming overweight and obese. While South Africa published draft regulations to limit the marketing of unhealthy foods to children, limited research examining the packaging of foods in South African supermarkets, have been done.

This literature review describes childhood obesity as a public health crisis, including the global childhood obesity epidemic, the consequences of childhood obesity, and the need for urgent action and childhood obesity within a South African perspective. Furthermore, the food system is discussed as the main driver of the obesity epidemic and the role that the food environment plays in shaping the dietary behaviours of children is explained. From there the literature review focusses on the marketing of food to children and discusses literature regarding the nature and extent of child-orientated food marketing. The review specifically explores the research available regarding the labelling of foods and its effects on the preferences and consumption of children. Lastly, the literature review discusses monitoring the labelling of foods in the South African supermarket as the necessary step towards supporting the need for policy action and creating effective interventions to tackle childhood obesity within South Africa.

2.2 The global childhood obesity epidemic

Childhood overweight and obesity (onward referred to as childhood obesity) is a public health concern affecting many children globally. With studies describing this crisis as an epidemic, the prevalence of childhood obesity is still on the rise (NCD-RisC, 2017:2639; Ng *et al.*, 2014:774; UNICEF *et al*., 2021). A child is classified as overweight when their weight is too heavy for their height. Overweight and obesity is a form of malnutrition that develops when energy intake exceeds energy expenditure (UNICEF *et al.*, 2021). There are many established adverse effects that obesity has on the health and social wellbeing of children. Therefore, urgent action is needed to stop the rising trend of childhood obesity.

A recent study regarding global body mass index (BMI) trends, showed that the mean BMI of children and adolescents 5-19 years of age, has increased in most countries over the last few decades (NCD-RisC, 2017:2635). The study confirmed that the prevalence of childhood obesity increased globally from 0.9% and 0.7% in 1975 to 7.8% and 5.6% in 2016 for boys and girls, respectively. This means that in 2016, there was a total of 124 million obese boys and girls globally.

Not every country experienced the same increase in the BMI of children. While the rising BMI trend has started to plateau in some high-income countries, it has accelerated in low- and middle-income countries (LMICs) and remains a challenge with research showing a high prevalence of overweight and obese children (Adom *et al.*, 2019:497; Caleyachetty *et al.*, 2018:421; Ng *et al.*, 2014:775). The prevalence of overweight children in LMICs under the age of 5 years increased from 5.2% (30 million) in the year 2000 to 6% (55.5 million) in 2017, indicating that children are already starting to become overweight at a young age (L.B.D. Double Burden of Malnutrition Collaborators, 2020:751). These countries are likely going to experience ongoing increases if no effective interventions are put in place. Initially, the prevalence of obesity in LMICs seemed to be higher in groups of high socioeconomic status in urban areas but it is increasingly affecting groups of low socioeconomic status and rural areas as the economy transitions towards a higher gross domestic product (GDP) (Adom *et al.*, 2019:497; Swinburn *et al.*, 2011:806; Templin *et al.*, 2019:11).

The rising prevalence of childhood obesity in LMICs, despite existing high levels of malnutrition in the form of underweight, stunting and micronutrient deficiencies, is leading to the emergence of a double burden of malnutrition (DBM) whereby individuals or members of the same households or communities are living with both undernutrition and overnutrition (Akombi *et al.*, 2019:9; Caleyachetty *et al.*, 2018:417; L.B.D. Double Burden of Malnutrition Collaborators, 2020:756; Tzioumis & Adair, 2014:231). Children in LMICs are thus increasingly exposed to different forms of malnutrition during their lifetime. For example, Tzioumis and Adair (2014:238) explain that within an individual, obesity can co-exist with micronutrient deficiencies such as iron-deficiency anaemia. They mention that this can be as a result of energy-dense but nutrient-poor diets that displaces micronutrients, or because of metabolic changes due to obesity that leads to poor absorption or increased requirements of micronutrients. This presents a further challenge whereby countries need to address both forms of malnutrition without the interventions being contradictory or in opposition.

The recent Coronavirus Disease (COVID-19) has caused major disruptions in most people's lives and the full extent of its impact is yet to be understood. The sudden changes in children's diet and physical activity because of the pandemic is likely to affect their nutritional

status and BMI trends and might not be easily reversible (Ruiz-Roso *et al.*, 2020:4-5; Stockwell *et al.*, 2021:3; Zemrani *et al.*, 2021:2-3). There is evidence emerging that the rate of weight gain in children (aged 6-17 years) has increased during the pandemic and that this increase was highest in those children that were already more vulnerable to unhealthy weight gain, including children with pre-existing obesity (Brooks *et al.*, 2021:5). However, Azoulay *et al.* (2021:5) found that the weight status and body composition of some children improved while others remained relatively stable, including those with overweight or obesity. It is important to expand post-pandemic research efforts within this scope, especially in LMICs, to determine the extent to which the pandemic affected the BMI trends of children.

The need to prevent obesity in childhood has become a global priority. The 65th and 66th World Health Assembly (WHA) endorsed the Comprehensive Implementation Plan on Maternal, Infant and Young Child Nutrition and the Global Action Plan for the Prevention and control of NCDs 2013-2020, respectively. These plans include global targets to halt the increase of overweight in children less than 5 years of age and to halt the rise of obesity in adolescents by the year 2025 (WHO, 2013; WHO, 2014).

2.3 The consequences of childhood obesity

It is well known that there are numerous health consequences related to childhood obesity placing children at risk of developing co-morbidities and various other complications. In addition to immediate and long-term health consequences to the individual, childhood obesity can also affect the healthcare system and economy of a country.

Along with the rise in childhood obesity, childhood hypertension is becoming more prevalent and is associated with a higher BMI (Song *et al.*, 2019:1160). The global prevalence of hypertension in all children 19 years and younger is 4% but among those with obesity, the prevalence is 15.27%. It is important to take the BMI trajectories of children into account to understand how the patterns of BMI can influence their risk of co-morbidities. Early onset obesity or overweight trajectories during childhood is associated with an increased risk of hypertension during late adolescence or young adulthood (Munthali *et al.*, 2016:5; Teng *et al.*, 2021:4). Teng *et al.* (2021:5) further indicated that, even when their BMI remained within the normal range, those with a rapid increase in BMI during childhood were at risk of developing hypertension during young adulthood.

Children with an increased BMI or waist circumference (WC) have a significantly higher prevalence of cardiometabolic risk factors during childhood such as raised blood pressure, dyslipidaemia (abnormal total cholesterol, triglycerides and high-density lipoprotein

cholesterol (HDL-C) levels), hyperglycaemia, glycated haemoglobin (HbA1c) and a high insulin profile, and higher high-sensitivity C-reactive protein (hs-CRP), with many obese children already living with more than one of these cardiometabolic risk factors (Friedemann *et al.*, 2012:3; Sanders *et al.*, 2015:738; Skinner *et al.*, 2015:1310-1311). More importantly, a greater severity of obesity is associated with a higher prevalence of cardiometabolic risk factors in these children (Friedemann *et al.*, 2012:4; Skinner *et al.*, 2015:1310). These risk factors and conditions were usually only prevalent among adults, but it is now becoming an emerging public health problem in children.

Similar to high-income countries, metabolic syndrome (a group of cardio-metabolic risk factors) is now significantly more prevalent among overweight and obese children in LMICs, with abdominal obesity being the most common component (Bitew *et al.*, 2020:6). Furthermore, children with obesity are at a greater risk of developing other co-morbidities such as non-alcoholic fatty liver disease (NAFLD) and asthma during childhood (Pulgarón, 2013:A25; Sanders *et al.*, 2015:738). Psychological co-morbidities such as a lower perceived quality of life, depression, emotional and behavioural disorders, and lower self-esteem are also common among children with obesity resulting in these children experiencing bullying and teasing more often (Rankin *et al.*, 2016:141; Sanders *et al.*, 2015:739). The psychological consequences of obesity in children can easily be underestimated and underlines the extent to which children's health is affected by obesity.

The negative health effects of childhood obesity are not only confined to childhood. Children with obesity are more likely to carry their obesity into adulthood, increasing their risk of obesity-related morbidity and mortality (Reilly & Kelly, 2011:894; Rundle *et al.*, 2020:229; Simmonds *et al.*, 2015:122; Ward *et al.*, 2017:2149). Children who were obese during childhood has a three times higher risk of mortality in early adulthood (Lindberg *et al.*, 2020:8).

Childhood obesity is an important risk factor for NCDs during adulthood. Umer *et al.* (2017:18) found that childhood obesity is positively associated with adult systolic blood pressure, diastolic blood pressure and low-density lipoprotein cholesterol (LDL-C), all of which are risk factors for cardiovascular disease (CVD). Childhood BMI is also associated with an increased risk of adult morbidities such as diabetes, coronary heart disease and some cancers (Llewellyn *et al.*, 2015:63; Reilly & Kelly, 2011:893; Simmonds *et al.*, 2015:121; Sommer & Twig, 2018:2).

The leading risk factors for mortality and disability-adjusted life-years (DALYs) globally, are a high systolic blood pressure, smoking, high fasting blood glucose and a high BMI (GBD 2017

Risk Factor Collaborators, 2018:1925). According to World Health Organization (WHO) estimates, seven of the top 10 causes of mortality globally are NCDs, making NCDs the leading cause of death worldwide (WHO, 2020). NCD related deaths of 4.7 million (17.7%) were attributed to a high BMI, which was projected to increase to 5.5 million by 2025 (Lin *et al.*, 2020:312). Although sub-Saharan Africa continues to experience a high burden of infectious diseases, the prevalence of NCDs continues to increase (Gouda *et al.*, 2019:e1385) and the probability of dying from NCDs is highest in LMICs, especially in sub-Saharan Africa (Bennett *et al.*, 2018:1081). This poses a great threat to health care systems that have largely been focussed on infectious disease and maternal, neonatal, and child deaths and have a low capacity to handle the growing NCD burden (Bollyky *et al.*, 2017:1870). Moreover, obesity and its related morbidities increases healthcare utilization and decreases workforce productivity that inevitably result in higher costs associated with obesity (Lehnert *et al.*, 2013:112).

By preventing childhood obesity, the magnitude of adult morbidities and mortalities can be reduced. Bearing in mind that obesity is a modifiable risk factor, it necessitates prioritizing this matter as part of the larger battle against NCDs. To overcome the global NCD burden, urgent attention is required to end the childhood obesity epidemic.

2.4 The South African perspective

In South Africa, the rise of childhood obesity is evident. South Africa was one of the top 20 countries with the most rapid increase in the prevalence of childhood obesity from the year 2000-2013 and is listed among the top 20 highest-ranking countries for the most overweight children predicted by the year 2025, with an estimated 3.9 million overweight South African children by 2025 (Lobstein & Jackson-Leach, 2016:323). Research have shown that the current trends in South Africa, reflect similar global trends, specifically in other LMICs and that the health consequences of childhood obesity are also prevalent in South African children.

Compared to earlier national studies, results from the South African National Health and Nutrition Examination Survey (SANHANES-1) showed that the prevalence of both overweight and obesity among children aged 6-9 years increased from 7.8% and 2.5% in 2005 to 8.4% and 3.4% in 2013, respectively (Shisana *et al.*, 2014:209). Overweight and obesity was also highest in formal and informal urban areas. The high prevalence of childhood obesity in South Africa was confirmed by a more recent study by Negash *et al.* (2017:3) indicating that 22.9% of children aged 7-18 years were overweight or obese and

despite their youth, those who were overweight or obese were more likely to have hypertension, hypertriglyceridemia and high HDL-C levels, depending on their race.

South African children, especially those of African descent, are becoming increasingly prone to developing CVDs. Matjuda *et al.* (2020:5) confirmed that hypertension and obesity are already prevalent in South African children aged 6-9 years and associated with renal-cardiovascular risks. In black South African children, BMI trajectories with early onset overweight or obesity, are associated with elevated blood pressure in late adolescence (Munthali *et al.*, 2016:5). It is important to prioritise the nutritional status of children in South Africa considering the harmful impact childhood obesity can have on children during their lifetime.

Similar to other LMICs, South Africa is also facing a DBM whereby undernutrition and overweight and obesity coexist in individuals or among the same household or community (Modjadji & Madiba, 2019:5; Monyeki *et al.*, 2015:1165; Rossouw *et al.*, 2012:2; Senekal *et al.*, 2019:8). Symington *et al.* (2016:67) confirmed the co-existence of under and over nutrition in South African children with their study showing that the majority of children in the obese group (68.4%) were also stunted. South Africa is one of the LMICs with the highest co-existence of undernutrition and overweight or obesity in children under 5 years of age (Akombi *et al.*, 2019:9).

From the literature provided above, it is evident that childhood obesity is increasing at an alarming rate in South Africa and already contributing to the NCD burden. If this rise continues, SA will not meet the WHA 2025 and SDG 2030 targets. It is important to keep up to date with the trends, globally as well as in South Africa, to fully comprehend the challenges arising and respond swiftly. The prevalence of childhood obesity can help to serve as indication of the potential demand of health care services that South Africa is likely to face in the future. The increase in obesity-related co-morbidities will undoubtedly affect the future of South African children, households, and the society, overwhelming an already strained health care system. The presence of a DBM in South Africa further complicates possible obesity prevention strategies as multiple forms of malnutrition need to be addressed simultaneously.

2.5 The food environment as a key driver of obesity

Childhood obesity is complex and there are many factors contributing to the rise in its prevalence. Energy balance is closely determined by the behavioural patterns of individuals (such as energy intake and physical activity) (Swinburn *et al.*, 2011:808) and children are

exposed to multiple 'obesogenic' (obesity-promoting) food environments that negatively affect their dietary behaviours (Sonntag *et al.*, 2015:8572).

The food system is recognized as a key driver in the global obesity epidemic (Swinburn *et al.*, 2011:807). The availability of cheap, highly palatable and energy-dense but nutrient-poor foods (commonly referred to as ultra-processed foods [UPF] [Monteiro *et al.*, 2013:23]), coupled with improved distribution and compelling marketing techniques, are creating food environments that drive overconsumption and weight gain (Swinburn *et al.*, 2011:807). The food environment is where consumers interact with the food system, making it an important area of focus to determine how the food system influences the dietary behaviours of consumers. Downs *et al.* (2020:5) define the food environment as 'the consumer interface with the food system that encompasses the availability, affordability, convenience, promotion and quality, and sustainability of foods and beverages'. Research shows that the food environment influences the dietary intake of children (Engler-Stringer *et al.*, 2014:12) and Signal *et al.* (2017:8) report that, excluding supermarkets and convenience stores, children are mostly exposed to the marketing of unhealthy food at home, public spaces and school. Environmental exposures most associated with an increased risk of weight gain in young children are the availability of sugar-sweetened beverages, portion sizes and food promotion (Osei-Assibey *et al.*, 2012:10) and the food environment plays a vital role in the childhood obesity epidemic.

The industrialization and globalization of food systems are causing more countries to transition towards a higher consumption of UPFs and evidently the sales of UPFs have grown rapidly in LMICs (Baker *et al.*, 2020:9; Popkin *et al.*, 2020:69). Along with the increased types and amount of UPFs available in LMICs, rapid urbanisation and acculturation have resulted in many children living in closer proximity to these foods and more children are now being raised in obesogenic food environments (Baker *et al.*, 2020:9; Engler-Stringer *et al.*, 2014:12; Sonntag *et al.*, 2015:8572; Swinburn *et al.*, 2011:807). Besides the poor nutritional content of UPFs, the consumption of UPFs has been shown to increase energy intake (Hall *et al.*, 2019:69) and is associated with a higher BMI (Louzada *et al.*, 2015:11) and these foods are therefore considered unhealthy, especially when consumed in large amounts.

Likewise, South Africa is also experiencing a nutrition transition characterised by a high energy intake (from added sugar, animal protein and total fat), an inadequate micronutrient intake and accompanying increases in BMI and WC (Vorster *et al.*, 2014:1484; Wentzel-Viljoen *et al.*, 2018:2639). This is also evident in low-income communities where a higher intake of sugar-sweetened beverages showed a higher risk of weight gain (Okop *et al.*,

2019). With regard to children, research shows an increased intake of refined foods and foods high in salt and sugar and a lower intake of nutrient-dense foods such as fruit, vegetables and legumes, (Steyn *et al.*, 2020:13-17). As a result of the displacement of micronutrients in their diet, many children are not reaching their Estimated Average Requirement (EAR) for various nutrients, putting them at risk of developing anaemia and iron deficiency (Visser *et al.*, 2019:196; 2021:4).

The food environment is the common factor to which those with malnutrition, both over- and undernutrition, in a population are exposed to (Swinburn *et al.*, 2011:811). Given that the food environment is where consumers make many of their food choices, it provides many opportunities to motivate better dietary behaviours and to address the wider burden of malnutrition within LMICs.

While the decision to consume a specific food remains an individual choice, it is difficult to change behaviours in an environment that constantly promotes the consumption of unhealthy foods and a sedentary lifestyle. Although some food preferences are innate, others are learned over time through repeated exposures. Cohen (2008:1772) explains that the food environment can stimulate automatic reflexive responses that increase the desire to eat and subsequently lead to subconscious decisions and overconsumption. Children also have certain age-specific characteristics that affect their interaction with the food system that can make them more vulnerable to specific aspects of the food environment, compared to adults (Fox & Timmer, 2020:5). Young children, for example, have limited individual and intrapersonal capacity and their diets are largely determined by their environment (specific actions at interpersonal level, physical and social settings, and macro-level and policy environments) (Fox & Timmer, 2020:8). Strategies to improve the diets of children should take their characteristics into account when designing interventions.

The complexity of childhood obesity makes possible interventions complicated. Although obesity can be addressed in a clinical setting with a multi-disciplinary team, it is not an adequate intervention for a population scale problem. The development of nutrition policies that address the underlying drivers of obesity and reverse the obesogenic nature of the food environments should be a priority (Swinburn *et al.*, 2011:810). Policies that create environments that enable children to learn healthy food preferences, overcome barriers to choosing healthy foods and encourage children to reassess their unhealthy food preferences when purchasing foods, can make healthy food choices not only easy, but the preferred choice (Hawkes *et al.*, 2015:2417). The responsibility of creating a healthy food environment should not only lie with food companies. The food industry has a financial investment into creating overweight as it drives overconsumption in children that will continue

overconsumption into adulthood, creating a market for the food (Lobstein *et al.*, 2015:2516). UPFs are highly palatable, cheap and have a long shelf life making these foods especially profitable (Swinburn *et al.*, 2019:17). While some food and beverage companies pledged to reduce the children's exposure to the marketing of unhealthy foods, research shows voluntary self-regulation is not effective in restricting the marketing of unhealthy foods (Huizinga & Kruse, 2016:26). Obesity strategies should primarily be policy-led and require strong government leadership, regulation, and monitoring.

The change in the food environment and the impact it has on obesity, encouraged national and global efforts to improve the food environment, with many recommendations addressing the marketing of unhealthy foods to children. The WHO published a set of recommendations on the marketing of foods and non-alcoholic beverages to children, which advocates the implementation of policies to reduce the exposure of children to the marketing of unhealthy foods (WHO, 2010). The Commission on Ending Childhood Obesity also published a report in 2016 with recommendations to address childhood obesity (WHO, 2016b). They recognise that an environmental approach is required, and their first strategic objective is to address the obesogenic environment that children are exposed to. They identified the marketing of unhealthy food to children as part of the first key area of action. The commission urged to reduce the exposure of children to such marketing in an effort to promote healthy food and to decrease the intake of unhealthy food.

In response to this, many countries are now implementing child-orientated food marketing restrictions to regulate the marketing of unhealthy food to children. Chile, for example, implemented the Law of Food Labelling and Advertising (Law 20.606) in 2016, that includes a nutritional profile limit for energy, fat, sugar or salt, and foods containing excess amounts of these nutrients should be marked with a front-of-package black warning stating "high in calories" (or the specific nutrient) (Corvalán *et al.*, 2019:371). The regulated foods are prohibited from being sold within preschool and elementary schools and the foods may not be advertised to children under the age of 14 years, including giving out toys, accessories, stickers, etc. along with the foods. Although there are still some aspects of the regulation that requires reconsideration (e.g., that foods with warnings can still carry health claims as long as the claim relate to other nutrients) it is a step in the right direction. Reyes *et al.* (2020:18) examined the nutritional composition of foods after the implementation of the Chilean law and found a significant reduction in the number of unhealthy foods, more specifically the amount of sugar and sodium decreased in several food groups.

Recognising the need for a policy to restrict children's exposure to the marketing of unhealthy foods, the South African National Department of Health (SANDoH), Directorate:

Food Control, published a draft regulation for comments in 2014 (Department of Health, 2014), aiming to restrict the marketing of all unhealthy foods to children. The draft regulations recommend using a nutrient profiling model to determine which foods are healthy or unhealthy and which foods are suitable of carrying a claim. A nutrient profiling model is defined as the science of classifying foods according to their nutritional composition by reason of their ability to promote health or prevent disease (Rayner *et al.*, 2004). Although these proposed Regulations would make it possible to control marketing to children, it has not been promulgated yet. Additionally, the SANDoH also published the National Strategy For The Prevention And Control Of Obesity 2015-2020 (Department of Health, 2015) to halt the rise of obesity in South Africa. The strategy emphasizes the need for a multi-sectoral approach to create an environment that promotes healthy eating and increases the availability of healthy food. One of the objectives is to ensure responsible and ethical advertising of foods by the food industry. The strategy has set a target to prevent and reduce the prevalence of obesity by 10% by the year 2020. Unfortunately, the process of developing and implementing policies to achieve this has been slow.

2.6 Marketing of foods to children

Marketers target children because they are able to influence purchasing decisions in more than one way. Children are independent consumers (they often use pocket money to buy snacks and confectionaries), they can influence household purchases and as future adult consumers, targeting children is a strategy used to build brand loyalty and create future loyal adult consumers (Kraak & Story, 2015:16; Story & French, 2004:3). In this way, the food industry ensures that there will be a continuous market for their foods in the future.

The marketing of food can affect children's dietary behaviours. Research shows that food marketing affects the amount of purchasing requests made to parents and the food preferences of children (Boyland & Halford, 2013:239; Kraak & Story, 2015:16; Roberto *et al.*, 2010:91) and that the food preferences learned during childhood often persist throughout their lifetime (Hawkes *et al.*, 2015:2412). Moreover, exposing children to food marketing can specifically influence their attitudes, preferences, and consumption of unhealthy foods (Boyland & Whalen, 2015:519; Smith *et al.*, 2019:5). Marketing that targets children and create the idea of 'fun food' not only leads to excessive energy intake and unhealthy food consumption, but can also negatively impact the relationship that children have with food. Elliott (2008:376) explains that such marketing can teach children to consume food for entertainment reasons or distraction rather than for nutrition purposes.

The amount of child-orientated foods in supermarkets are increasing (Elliott, 2019:9). Child-orientated food marketing is extensive and research indicates that it primarily concerns the promotion of unhealthy foods (Cairns *et al.*, 2013:212; Elliott, 2019:4; Lavriša & Pravst, 2019:4; Signal *et al.*, 2017:6; Tatlow-Golden & Garde, 2020:2). Signal *et al.* (2017:6) recently reported that children are exposed to twice as much marketing of unhealthy food compared to healthy food.

Marketers frequently use themes such as appeals to taste, humour, action-adventure, fantasy and fun to advertise food (Cairns *et al.*, 2013:213). The nature of food promotion in LMICs is similar to that of high-income countries in terms of strategies, techniques and mediums used and is focussed on newer, modern foods such as fast-food and carbonated soft drinks (Cairns *et al.*, 2013:213; Popkin *et al.*, 2012:8; Pries *et al.*, 2019:4). In South Africa Mchiza *et al.* (2013) indicated that marketing strategies used by television are similar to other countries and includes persuasive appeals that target more than one sensory mode (vision and auditory).

The effectiveness of food marketing depend on the function of exposure to (reach, frequency and impact), and the power of (the content, design and execution) the marketing messages (WHO, 2010). Food companies use several marketing strategies, mediums, and techniques to effectively advertise their foods to children. Although television advertising was a very popular marketing medium, Cairns *et al.* (2013:212) identified multiple other mediums that food marketers now use to promote their foods such as internet-mediated marketing, direct mail marketing, mobile phone messaging, magazines, comics and other form of print, point of sale, free samples, gifts and tokens, packaging, loyalty schemes, tie-ins with licensed characters and television programmes, sponsorship and in-school marketing, and many more.

Digital marketing is also emerging as a powerful marketing medium that offers more powerful marketing techniques (Tatlow-Golden & Garde, 2020:3). Consequently the WHO also published recommendations for the digital marketing of unhealthy foods to children online (WHO, 2016a). Marketers can manipulate the behaviour of children and extract data from children to deliver targeted marketing messages that are more personalised and thus can be more persuasive (WHO, 2016a). This indicates that marketing to children is becoming more extensive and requires well designed interventions.

Furthermore, the marketing of foods has also been discussed from a children's rights perspective, stating that children have the right for their health to be protected and not to be economically exploited (Tatlow-Golden & Garde, 2020:4). Children are more vulnerable to

marketing because they are not yet able to recognise the real intent of marketing and its purpose to persuade customers to purchase the food (Carter *et al.*, 2011:966). Studies have shown that exposing children to the marketing of unhealthy food and non-alcoholic beverages can cause them to consume excess energy and gain weight (Boyland *et al.*, 2016:531; Sadeghirad *et al.*, 2016:953). The vulnerability of children is being exploited by specifically targeting them, leading to negative health consequences.

2.7 Food packaging as a marketing medium

Food packaging is another marketing medium with which the food industry can entice children to buy their products. Food packaging is unique in that it is present at both the purchasing and the consumption of a food and therefore the packaging of food can influence food choices and eating behaviour (Chandon, 2013:8; Hallez *et al.*, 2020:11-12; Skaczkowski *et al.*, 2016:231). Food packaging can easily be designed to attract children and persuade them to choose specific foods. For example, adding a licensed character on the food packaging can influence their perception of taste as well as their preference for a certain food (Letona *et al.*, 2014:1468; Roberto *et al.*, 2010:91). Hallez *et al.* (2020:7) found that children are specifically influenced by licenced endorsers and product illustrations, but it is still unclear how this can affect the intake when used on the packaging of healthy foods. Moreover, the packaging of foods can also influence children to eat more. An exaggerated serving size on the package lead children to eat more of a specific food (Hallez *et al.*, 2020:7).

There are also other techniques that can make a food seem more appealing to children such as cross promotions and tie-ins with children's television programs, unusual shapes and bright colours, as well as wording that refer to fun or play, to mention a few (Mehta *et al.*, 2012:1765). A recent study by Signal *et al.* (2017:6) showed that food packaging is the most frequent marketing medium that children are exposed to.

Children of different socioeconomic levels can also perceive food labels differently. Arrúa *et al.* (2017:215) showed that low-income children seem more susceptible to marketing strategies of food, describing foods as tastier, funnier, and more healthful than middle- or high-income children.

Choosing healthy foods can be overwhelming for children. In attempts to evaluate the healthfulness of packaged foods, children used label colours, spokes-characters, pictures, and front-of-package (FOP) claims to support their decision (Elliott & Brierley, 2012:454). Rodrigues *et al.* (2016:2053) found that children's foods with nutrient claims had either a

similar or worse nutritional content than their counterparts without nutrient claims. This may be harmful as these unhealthy foods can appear ‘healthy’ within the eyes of the consumers due to their claims.

Abrams *et al.* (2015:26) points out that the packaging of foods, including visual and verbal claims, also affect the parent’s perception of a certain food. They found that visuals of fruit and more realistic pictures as well as health claims on the foods caused parents to believe a food is healthier. Regulations are also necessary to prevent misleading parents that are in search of healthy food options for their children.

The packaging of foods is a potent marketing medium and, considering that children encounter it in almost every setting of their daily lives, it warrants further investigation. An environment that constantly targets children and promotes unhealthy foods, makes it challenging for them to maintain a healthy lifestyle. A food environment that encourages healthy dietary behaviour should be created and protecting children against exploitative marketing plays an integral part in this. Food policies within the nutrition labelling area can induce a positive food system response and help individuals overcome barriers to developing healthy preferences by providing them with more information (Hawkes *et al.*, 2015:2411). Improvements in the packaging of child-orientated foods thus offers the opportunity to tackle childhood obesity at the point of purchase.

2.8 Marketing techniques used on child-orientated food packaging

Food packaging is widely used as a marketing medium to target children in supermarkets (Chapman *et al.*, 2006:334; Devi *et al.*, 2014:257; Harris *et al.*, 2009:412; Mehta *et al.*, 2012:1767). Children are commonly targeted by using promotions based on claims, promotional characters (such as television or movie characters, cartoon or company owned character, licenced character) and cross-promotions with third-party characters, celebrities and premium offers (Chapman *et al.*, 2006:336; Devi *et al.*, 2014:258; Harris *et al.*, 2009:412; Mehta *et al.*, 2012:1767). In fact, Mehta *et al.* (2012:1565) found a median of 6.43 individual marketing techniques used per food. The most dominant marketing techniques across research studies vary and, in some cases, only a specific technique, for example claims, were examined. The themes of fun and fantasy are apparent and lacked any reference to good health and nutrition. Among breakfast cereals targeting children, Berry and McMullen (2008:344) found that spokes-characters, themed cereal shapes or colours and child incentives on the cereal box were more likely to be associated with a higher sugar, refined grains and trans-fats content. Similar results have been found in Guatemala, which

showed that the most common marketing technique used was promotional characters (92.5%) (Chacon *et al.*, 2013:4).

Elliott (2019:9-10) assessed the changes in child-orientated supermarket foods in Canada from 2009 to 2017, and reported that, the food did not improve nutritionally, and that sugar levels remained consistently high. Despite the poor nutritional value of the food, the use of nutrition claims on the front of the food packaging increased. The author further mentions that the use of cartoon characters and appealing fonts increased over time while character licensing remained consistent. This highlights the importance and value of continued monitoring of the food environment so that interventions can be evaluated and adjusted accordingly.

There is limited research regarding the marketing techniques used on packaged foods in South Africa. Wiles (2017:13) reported that the majority of ready-to-eat breakfast cereals that targeted children had a nutrient content claim, mostly regarding fibre and vitamins and minerals. Bursey *et al.* (2021:66) examined the claims used on snack foods in South African supermarkets and pharmacies. Although their study did not investigate child-orientated foods specifically, nutrient content claims which relate to fibre were also most prevalent. There is currently insufficient research about the marketing techniques used on the other food categories, specifically those aimed at children.

The marketing techniques used on foods are especially important due to the role that it plays in purchase decisions and food preferences. More research is required to understand how marketers use food packaging to target children in South African supermarkets.

2.9 Healthiness of child-orientated foods

Multiple studies have investigated the healthiness of child-orientated foods. Studies found that the foods with child-orientated packaging in Australian (Mehta *et al.*, 2012:1766), New Zealand (Devi *et al.*, 2014:256), American (Harris *et al.*, 2009:413), Canadian (Berry & McMullen, 2008:342), Slovenian (Lavriša & Pravst, 2019:4), Brazilian (Machado *et al.*, 2019:5) and European (Storcksdieck genannt Bonsmann *et al.*, 2019:7) supermarkets are predominantly unhealthy foods (around 72%-93% of selected child-orientated food were unhealthy) and thus not actually suitable to be marketed to children. Some of the food categories with the most child-focussed promotions were breakfast cereals, chocolate and sugar confectionaries, soft drinks, dairy, savoury snacks, fast food, and edible ices. In contrast, the foods that were least likely to target children were fruits and vegetables.

Additionally, many authors also noted that overall child-orientated foods seem to be less healthy compared to similar food in other categories or adult-orientated foods (Devi *et al.*, 2014:259; Lavriša & Pravst, 2019:6; Machado *et al.*, 2019:8). Child-orientated foods mostly had less protein, more carbohydrates, and a lower fibre content per 100g. Furthermore child-orientated foods such as breakfast cereals, bread and crackers contained more refined ingredients (such as refined flours as opposed to wholegrain flours), compared to similar foods that does not target children (Machado *et al.*, 2019:8).

In addition, some authors stated that the serving sizes of some child-orientated foods were smaller than similar foods in other categories or adult-orientated foods, but that the sugar and energy content were significantly higher per 100g (Devi *et al.*, 2014:259; Machado *et al.*, 2019:9). This can easily lead to overconsumption if the child consumes more than the recommended serving size.

In South Africa, research regarding the healthiness of child-orientated foods is limited. Wiles (2017:13) examined breakfast cereals available in South Africa, and found that per 100g, children's cereals had significantly higher amounts of carbohydrates, sugar and sodium compared to non-children's cereals. However, due to smaller serving sizes of children's cereals, the same difference was not found per serving size. This can be deceiving when children or parents do not realise the cereal is more nutrient dense and the servings should be smaller than other non-children's cereals. Around 70% of the children's cereals would not be eligible to make a nutrition claim if the 2014 draft regulation is promulgated. In addition, the non-children's breakfast cereals offered better quality nutrients like protein, monounsaturated and polyunsaturated fat, fibre, and micronutrients content per 100g and per serving size. Comparingly, Wicks *et al.* (2017:2153) examined the foods advertised on South African free-to-air television channels and found that most frequently advertised foods were high in fat, sugar and/or salt (HFSS) foods, composite dishes or sugar-sweetened beverages. Additionally, they used multiple nutrient profiling models to classify the foods and found that most foods were unhealthy and only 6 to 42% (depending on the nutrient profile model) of the foods classified, would be allowed to market to children. Similarly, Mchiza *et al.* (2013:4) also investigated child-orientated foods advertised on television and found that the majority of foods marketed were unhealthy despite airing during children or family viewing time.

More research is required to understand the types of food marketed to children in South African supermarkets and the nutritional content thereof.

2.10 Benchmarking the South African food environment

From the literature, it is evident that the current food environment is harmful to children. A child-centred food system should make healthy diets available, affordable, appealing and aspirational for children in order to create food environments that help children create healthier diets (Hawkes *et al.*, 2020). It is thus important to understand the food environment and the interplay of all its components. As part of their six steps to identify the actions needed to change the food system, Hawkes *et al.* (2020) recommend measuring the food environment, including the advertising and promotional components as Step 4. This can be done using the International Network for Food and Obesity / NCD Research, Monitoring and Action Support (INFORMAS) modules to assess multiple aspects.

INFORMAS was established in response to the obesity epidemic and the global NCD burden. INFORMAS is a global network of public-interest organizations and researchers aiming to monitor, benchmark and support public and private actions that help to create a healthy food environment that will lead to a reduction in obesity and NCDs (Swinburn *et al.*, 2013:14). INFORMAS provides protocols for monitoring multiple aspects of food environments that can be used to create a benchmark for food environments between countries. There are different modules, and each module is designed to answer a specific research question related to the food environment. These modules can be used to conduct studies with similar designs so that it can be repeated to monitor the progress a country has made or to compare the results with other countries.

The goal of INFORMAS is to influence policies and regulations to strengthen accountability systems by monitoring the food environment. Over the past few years, INFORMAS have contributed significantly to capacity building, increasing accountability for actions to improve food environments as well as policy development, implementation and evaluation (Sacks *et al.*, 2021:351-353). INFORMAS thus provides a starting point to tackling the obesity epidemic and it is a valuable framework that many countries can use. The flexibility of the modules and low level of resources required, also make it appropriate for many countries, including LMICs to use.

2.11 Conclusion

The childhood obesity epidemic is significantly affected by the food environment and obesity prevention strategies should focus on creating food environments that encourage healthy behaviour. Given that the packaging of foods is an influential medium that children are repeatedly exposed to, it holds many opportunities for action. Unfortunately, there is a lack of

evidence concerning the food environment in South Africa with regard to the packaging of foods in supermarkets which limits the ability to create effective policies that are appropriate for the population. In view of the DBM that South Africa is experiencing and the possible associated morbidities, comprehensive research within this scope should be prioritised.

BIBLIOGRAPHY

Abrams, K.M., Evans, C. & Duff, B.R. 2015. Ignorance is bliss. How parents of preschool children make sense of front-of-package visuals and claims on food. *Appetite*, 87:20-29. https://doi.org/10.1016/j.appet.2014.12.100

Adom, T., Kengne, A.P., De Villiers, A. & Puoane, T. 2019. Prevalence of overweight and obesity among African primary school learners: a systematic review and meta-analysis. *Obesity Science and Practice*, 5(5):487-502. https://doi-org.nwulib.nwu.ac.za/10.1002/osp4.355

Akombi, B.J., Chitekwe, S., Sahle, B.W. & Renzaho, A.M.N. 2019. Estimating the Double Burden of Malnutrition among 595,975 Children in 65 Low- and Middle-Income Countries: A Meta-Analysis of Demographic and Health Surveys. *International Journal of Environmental Research and Public Health*, 16(16), 2886. https://doi.org/10.3390/ijerph16162886

Arrúa, A., Vidal, L., Antúnez, L., Machín, L., Martínez, J., Curutchet, M.R., ... Ares, G. 2017. Influence of label design on children's perception of 2 snack foods. *Journal of Nutrition Education and Behavior*, 49(3):211-217. e211. http://dx.doi.org/10.1016/j.jneb.2016.10.021

Azoulay, E., Yackobovitch-Gavan, M., Yaacov, H., Gilboa, I., Lopez, A., Sheppes, T., ... Brener, A. 2021. Weight Status and Body Composition Dynamics in Children and Adolescents During the COVID-19 Pandemic. *Frontiers in Pediatrics*, 9:707773-707773. https://doi.org/10.3389/fped.2021.707773

Baker, P., Machado, P., Santos, T., Sievert, K., Backholer, K., Hadjikakou, M., ... Scrinis, G. 2020. Ultra-processed foods and the nutrition transition: Global, regional and national trends, food systems transformations and political economy drivers. *Obesity Reviews*, 21(12):e13126. https://doi-org.nwulib.nwu.ac.za/10.1111/obr.13126

Bennett, J.E., Stevens, G.A., Mathers, C.D., Bonita, R., Rehm, J., Kruk, M.E., ... Ezzati, M. 2018. NCD Countdown 2030: worldwide trends in non-communicable disease mortality and progress towards Sustainable Development Goal target 3.4. *Lancet*, 392(10152):1072-1088. https://doi.org/10.1016/S0140-6736(18)31992-5

Berry, B. & McMullen, T. 2008. Visual communication to children in the supermarket context: Health protective or exploitive? *Agriculture and Human Values*, 25(3):333-348. https://doi-org.nwulib.nwu.ac.za/10.1007/s10460-007-9110-0

Bitew, Z.W., Alemu, A., Ayele, E.G., Tenaw, Z., Alebel, A. & Worku, T. 2020. Metabolic syndrome among children and adolescents in low and middle income countries: a systematic review and meta-analysis. *Diabetology & Metabolic Syndrome*, 12(1), 93. https://doi.org/10.1186/s13098-020-00601-8

Bollyky, T.J., Templin, T., Cohen, M. & Dieleman, J.L. 2017. Lower-income countries that face the most rapid shift in noncommunicable disease burden are also the least prepared. *Health Affairs*, 36(11):1866-1875. https://doi.org/10.1377/hlthaff.2017.0708

Boyland, E.J. & Halford, J.C. 2013. Television advertising and branding. Effects on eating behaviour and food preferences in children. *Appetite*, 62:236-241.

Boyland, E.J. & Whalen, R. 2015. Food advertising to children and its effects on diet: review of recent prevalence and impact data. *Pediatric Diabetes*, 16(5):331-337. https://doi.org/10.1111/pedi.12278

Boyland, E.J., Nolan, S., Kelly, B., Tudur-Smith, C., Jones, A., Halford, J.C.G. & Robinson, E. 2016. Advertising as a cue to consume: a systematic review and meta-analysis of the effects of acute exposure to unhealthy food and nonalcoholic beverage advertising on intake in children and adults. *American Journal of Clinical Nutrition*, 103(2):519-533. https://doi-org.nwulib.nwu.ac.za/10.3945/ajcn.115.120022

Brooks, C.G., Spencer, J.R., Sprafka, J.M., Roehl, K.A., Ma, J., Londhe, A.A., ... Page, J. 2021. Pediatric BMI changes during COVID-19 pandemic: An electronic health record-based retrospective cohort study. *EClinicalMedicine*, 38(16), 101026. https://doi.org/10.1016/j.eclinm.2021.101026

Bursey, A.S., Wiles, N.L. & Biggs, C. 2021. The nutrient quality and labelling of ready-to-eat snack foods with health and/or nutrition claims. *South African Journal of Clinical Nutrition*, 34(2):65-71. https://doi-org.nwulib.nwu.ac.za/10.1080/16070658.2019.1682242

Cairns, G., Angus, K., Hastings, G. & Caraher, M. 2013. Systematic reviews of the evidence on the nature, extent and effects of food marketing to children. A retrospective summary. *Appetite*, 62:209-215. https://doi.org/10.1016/j.appet.2012.04.017

Caleyachetty, R., Thomas, G., Kengne, A.P., Echouffo-Tcheugui, J.B., Schilsky, S., Khodabocus, J. & Uauy, R. 2018. The double burden of malnutrition among adolescents: analysis of data from the Global School-Based Student Health and Health Behavior in School-Aged Children surveys in 57 low- and middle-income countries. *American Journal of Clinical Nutrition*, 108(2):414-424. https://doi-org.nwulib.nwu.ac.za/10.1093/ajcn/nqy105

Carter, O.B.J., Patterson, L.J., Donovan, R.J., Ewing, M.T. & Roberts, C.M. 2011. Children's understanding of the selling versus persuasive intent of junk food advertising: Implications for regulation. *Social Science & Medicine*, 72(6):962-968. https://doi.org/10.1016/j.socscimed.2011.01.018

Chacon, V., Letona, P. & Barnoya, J. 2013. Child-oriented marketing techniques in snack food packages in Guatemala. *BMC Public Health*, 13(1):967. https://doi.org/10.1186/1471-2458-13-967

Chandon, P. 2013. How package design and packaged-based marketing claims lead to overeating. *Applied Economic Perspectives and Policy*, 35(1):7-31. https://doi.org/10.1093/aepp/pps028

Chapman, K., Nicholas, P., Banovic, D. & Supramaniam, R. 2006. The extent and nature of food promotion directed to children in Australian supermarkets. *Health Promotion International*, 21(4):331-339. https://doi-org.nwulib.nwu.ac.za/10.1093/heapro/dal028

Cohen, D.A. 2008. Neurophysiological pathways to obesity: below awareness and beyond individual control. *Diabetes*, 57(7):1768-1773. https://doi-org.nwulib.nwu.ac.za/10.2337/db08-0163

Corvalán, C., Reyes, M., Garmendia, M.L. & Uauy, R. 2019. Structural responses to the obesity and non-communicable diseases epidemic: Update on the Chilean law of food labelling and advertising. *Obesity Reviews*, 20(3):367-374. https://doi-org.nwulib.nwu.ac.za/10.1111/obr.12802

Department of Health (South Africa). 2014. *Foodstuffs, cosmetics and disinfectants act, 1972 (No.54 of 1972): Regulations relating to the labelling and advertising of foods: amendment. (Notice R.429).* http://www.gpwonline.co.za/Gazettes/Gazettes/37695_29-5_Health.pdf Date of access: 8 February 2019.

Department of Health (South Africa). 2015. *Strategy for the prevention and control of obesity in South Africa 2015-2020*. https://www.knowledgehub.org.za/elibrary/national-strategy-prevention-and-control-obesity Date of access: 6 February 2019.

Devi, A., Eyles, H., Rayner, M., Mhurchu, C.N., Swinburn, B., Lonsdale-Cooper, E. & Vandevijvere, S. 2014. Nutritional quality, labelling and promotion of breakfast cereals on the New Zealand market. *Appetite*, 81:253-260. https://doi.org/10.1016/j.appet.2014.06.019

Downs, S.M., Ahmed, S., Fanzo, J. & Herforth, A. 2020. Food environment typology: advancing an expanded definition, framework, and methodological approach for improved characterization of wild, cultivated, and built food environments toward sustainable diets. *Foods*, 9(4), 532. https://doi.org/10.3390/foods9040532

Elliott, C. 2008. Assessing 'fun foods': nutritional content and analysis of supermarket foods targeted at children. *Obesity Reviews*, 9(4):368-377. https://doi-org.nwulib.nwu.ac.za/10.1111/j.1467-789X.2007.00418.x

Elliott, C. 2019. Tracking kids' food: comparing the nutritional value and marketing appeals of child-targeted supermarket products over time. *Nutrients*, 11(8), 1850. https://doi.org/10.3390/nu11081850

Elliott, C. & Brierley, M. 2012. Healthy choice?: Exploring how children evaluate the healthfulness of packaged foods. *Canadian Journal of Public Health*, 103(6):e453-e458. https://doi-org.nwulib.nwu.ac.za/10.1007/BF03405637

Engler-Stringer, R., Le, H., Gerrard, A. & Muhajarine, N. 2014. The community and consumer food environment and children's diet: a systematic review. *BMC Public Health*, 14(1):1-15. https://doi.org/10.1186/1471-2458-14-522

Fox, E.L. & Timmer, A. 2020. Children's and adolescents' characteristics and interactions with the food system. *Global Food Security*, 27, 100419. https://doi.org/10.1016/j.gfs.2020.100419

Friedemann, C., Heneghan, C., Mahtani, K., Thompson, M., Perera, R. & Ward, A.M. 2012. Cardiovascular disease risk in healthy children and its association with body mass index: systematic review and meta-analysis. *BMJ*, 345, e4759. https://doi.org/10.1136/bmj.e4759

GBD 2017 Risk Factor Collaborators. 2018. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*, 392(10159):1923-1994. https://doi.org/10.1016/S0140-6736(18)32225-6

Gouda, H.N., Charlson, F., Sorsdahl, K., Ahmadzada, S., Ferrari, A.J., Erskine, H., ... Whiteford, H. 2019. Burden of non-communicable diseases in sub-Saharan Africa, 1990–2017: results from the Global Burden of Disease Study 2017. *Llancet Global Health*, 7(10):e1375-e1387. https://doi.org/10.1016/S2214-109X(19)30374-2

Hall, K.D., Ayuketah, A., Brychta, R., Cai, H., Cassimatis, T., Chen, K.Y., ... Zhou, M. 2019. Ultra-Processed Diets Cause Excess Calorie Intake and Weight Gain: An Inpatient Randomized Controlled Trial of Ad Libitum Food Intake. *Cell Metabolism*, 30(1):67-77.e63. https://doi.org/10.1016/j.cmet.2019.05.008

Hallez, L., Qutteina, Y., Raedschelders, M., Boen, F. & Smits, T. 2020. That's my cue to eat: A systematic review of the persuasiveness of front-of-pack cues on food packages for children vs. adults. *Nutrients*, 12(4), 1062. https://doi.org/10.3390/nu12041062

Harris, J.L., Schwartz, M.B. & Brownell, K.D. 2009. Marketing foods to children and adolescents: licensed characters and other promotions on packaged foods in the supermarket. *Public Health Nutrition*, 13(3):409-417. https://doi.org/10.1017/S1368980009991339

Hawkes, C., Fox, E., Downs, S.M., Fanzo, J. & Neve, K. 2020. Child-centered food systems: Reorienting food systems towards healthy diets for children. *Global Food Security*, 27, 100414. https://doi.org/10.1016/j.gfs.2020.100414

Hawkes, C., Smith, T.G., Jewell, J., Wardle, J., Hammond, R.A., Friel, S., ... Kain, J. 2015. Smart food policies for obesity prevention. *Lancet*, 385(9985):2410-2421. https://doi.org/10.1016/S0140-6736(14)61745-1

Huizinga, O. & Kruse, M. 2016. Food industry self-regulation scheme “EU Pledge” cannot prevent the marketing of unhealthy foods to children. *Obesity Medicine*, 1:24-28. https://doi-org.nwulib.nwu.ac.za/10.1016/j.obmed.2016.01.004

Kraak, V.I. & Story, M. 2015. Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs. *Obesity Reviews*, 16(2):107-126. https://doi.org/10.1111/obr.12237

L.B.D. Double Burden of Malnutrition Collaborators. 2020. Mapping local patterns of childhood overweight and wasting in low- and middle-income countries between 2000 and 2017. *Nature Medicine*, 26(5):750-759. https://doi.org/10.1038/s41591-020-0807-6

Lavriša, Ž. & Pravst, I. 2019. Marketing of foods to children through food packaging is almost exclusively linked to unhealthy foods. *Nutrients*, 11(5), 1128. https://doi.org/10.3390/nu11051128

Lehnert, T., Sonntag, D., Konnopka, A., Riedel-Heller, S. & König, H.-H. 2013. Economic costs of overweight and obesity. *Best Practice & Research Clinical Endocrinology & Metabolism*, 27(2):105-115. https://doi.org/10.1016/j.beem.2013.01.002

Letona, P., Chacon, V., Roberto, C. & Barnoya, J. 2014. Effects of licensed characters on children’s taste and snack preferences in Guatemala, a low/middle income country. *International Journal of Obesity*, 38(11), 1466. https://doi.org/10.1038/ijo.2014.38

Lin, X., Xu, Y., Xu, J., Pan, X., Song, X., Shan, L., ... Shan, P.-F. 2020. Global burden of noncommunicable disease attributable to high body mass index in 195 countries and territories, 1990–2017. *Endocrine*, 69:310-320. https://doi.org/10.1007/s12020-020-02352-y

Lindberg, L., Danielsson, P., Persson, M., Marcus, C. & Hagman, E. 2020. Association of childhood obesity with risk of early all-cause and cause-specific mortality: A Swedish prospective cohort study. *PLoS Medicine*, 17(3):e1003078-e1003078. https://doi.org/10.1371/journal.pmed.1003078

Llewellyn, A., Simmonds, M., Owen, C.G. & Woolacott, N. 2015. Childhood obesity as a predictor of morbidity in adulthood: a systematic review and meta-analysis. *Obesity Reviews*, 17(1):56-67. https://doi.org/10.1111/obr.12316

Lobstein, T. & Jackson-Leach, R. 2016. Planning for the worst: estimates of obesity and comorbidities in school-age children in 2025. *Pediatric Obesity*, 11(5):321-325. https://doi.org/10.1111/ijpo.12185

Lobstein, T., Jackson-Leach, R., Moodie, M.L., Hall, K.D., Gortmaker, S.L., Swinburn, B.A., ... McPherson, K. 2015. Child and adolescent obesity: part of a bigger picture. *Lancet*, 385(9986):2510-2520. https://doi.org/10.1016/S0140-6736(14)61746-3

Louzada, M.L.d.C., Baraldi, L.G., Steele, E.M., Martins, A.P.B., Canella, D.S., Moubarac, J.-C., ... Monteiro, C.A. 2015. Consumption of ultra-processed foods and obesity in Brazilian adolescents and adults. *Preventive Medicine*, 81:9-15. https://doi.org/10.1016/j.ypmed.2015.07.018

Machado, M.L., Rodrigues, V.M., do Nascimento, A.B., Dean, M. & Fiates, G.M.R. 2019. Nutritional Composition of Brazilian Food Products Marketed to Children. *Nutrients*, 11(6):1214. https://doi.org/10.3390/nu11061214

Matjuda, E.N., Engwa, G.A., Letswalo, P.B., Mungamba, M.M., Sewani-Rusike, C.R. & Nkeh-Chungag, B.N. 2020. Association of Hypertension and Obesity with Risk Factors of Cardiovascular Diseases in Children Aged 6-9 Years Old in the Eastern Cape Province of South Africa. *Children*, 7(4), 25. https://doi.org/10.3390/children7040025

Mchiza, Z.J., Temple, N.J., Steyn, N.P., Abrahams, Z. & Clayford, M. 2013. Content analysis of television food advertisements aimed at adults and children in South Africa. *Public Health Nutrition*, 16(12):2213-2220. https://doi.org/10.1017/S136898001300205X

Mehta, K., Phillips, C., Ward, P., Coveney, J., Handsley, E. & Carter, P. 2012. Marketing foods to children through product packaging: prolific, unhealthy and misleading. *Public Health Nutrition*, 15(9):1763-1770. https://doi.org/10.1017/S1368980012001231

Modjadji, P. & Madiba, S. 2019. The double burden of malnutrition in a rural health and demographic surveillance system site in South Africa: A study of primary schoolchildren and their mothers. *BMC Public Health*, 19(1):1-11. https://doi.org/10.1186/s12889-019-7412-y

Monteiro, C.A., Moubarac, J.C., Cannon, G., Ng, S.W. & Popkin, B. 2013. Ultra-processed products are becoming dominant in the global food system. *Obesity Reviews*, 14(S2):21-28. https://doi.org/10.1111/obr.12107

Monyeki, M.A., Awotidebe, A., Strydom, G.L., de Ridder, J.H., Mamabolo, R.L. & Kemper, H.C.G. 2015. The challenges of underweight and overweight in South African children: are we winning or losing the battle? A systematic review. *International Journal of Environmental Research and Public Health*, 12(2):1156-1173. https://doi.org/10.3390/ijerph120201156

Munthali, R.J., Kagura, J., Lombard, Z. & Norris, S.A. 2016. Childhood adiposity trajectories are associated with late adolescent blood pressure: birth to twenty cohort. *BMC Public Health*, 16, 665. https://doi.org/10.1186/s12889-016-3337-x

NCD-RisC (NCD Risk Factor Collaboration). 2017. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. *Lancet* 390(10113):2627-2642. https://doi.org/10.1016/S0140-6736(17)32129-3

Negash, S., Agyemang, C., Matsha, T.E., Peer, N., Erasmus, R.T. & Kengne, A.P. 2017. Differential prevalence and associations of overweight and obesity by gender and population group among school learners in South Africa: a cross-sectional study. *BMC Obesity*, 4(1), 29. https://doi.org/10.1186/s40608-017-0165-1

Ng, M., Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., ... Gakidou, E. 2014. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*, 384(9945):766-781. https://doi.org/10.1016/S0140-6736(14)60460-8

Okop, K., Lambert, E., Alaba, O., Levitt, N., Luke, A., Dugas, L., ... Kolbe-Alexander, T. 2019. Sugar-sweetened beverage intake and relative weight gain among South African adults living in resource-poor communities: longitudinal data from the STOP-SA study. *International Journal of Obesity*, 43(3):603-614. https://doi.org/10.1038/s41366-018-0216-9

Osei-Assibey, G., Dick, S., Macdiarmid, J., Semple, S., Reilly, J.J., Ellaway, A., ... McNeill, G. 2012. The influence of the food environment on overweight and obesity in young children: a systematic review. *BMJ Open*, 2(6), e001538. http://dx.doi.org/10.1136/bmjopen-2012-001538

Popkin, B.M., Adair, L.S. & Ng, S.W. 2012. Global nutrition transition and the pandemic of obesity in developing countries. *Nutrition Reviews*, 70(1):3-21. https://doi.org/10.1111/j.1753-4887.2011.00456.x

Popkin, B.M., Corvalan, C. & Grummer-Strawn, L.M. 2020. Dynamics of the double burden of malnutrition and the changing nutrition reality. *Lancet*, 395(10217):65-74. https://doi.org/10.1016/S0140-6736(19)32497-3

Pries, A.M., Filteau, S. & Ferguson, E.L. 2019. Snack food and beverage consumption and young child nutrition in low- and middle-income countries: A systematic review. *Maternal & child nutrition*, 15(S4), e12729. https://doi.org/10.1111/mcn.12729

Pulgarón, E.R. 2013. Childhood Obesity: A Review of Increased Risk for Physical and Psychological Comorbidities. *Clinical Therapeutics*, 35(1):A18-A32. https://doi.org/10.1016/j.clinthera.2012.12.014

Rankin, J., Matthews, L., Cobley, S., Han, A., Sanders, R., Wiltshire, H.D. & Baker, J.S. 2016. Psychological consequences of childhood obesity: psychiatric comorbidity and prevention. *Adolescent Health, Medicine and Therapeutics*, 7:125-146. https://doi.org/10.2147/AHMT.S101631

Rayner, M., Scarborough, P. & Stockley, L. 2004. *Nutrient profiles: options for definitions for use in relation to food promotion and children's diets: Final report*. (London: Food Standards Agency). https://www.researchgate.net/publication/267198176_Nutrient_profiles_Options_for_definitions_for_use_in_relation_to_food_promotion_and_children%27s_diets_Final_report Date of access: 18 October 2021.

Reilly, J.J. & Kelly, J. 2011. Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. *International Journal of Obesity*, 35(7):891-898. https://doi.org/10.1038/ijo.2010.222

Reyes, M., Smith Taillie, L., Popkin, B., Kanter, R., Vandevijvere, S. & Corvalán, C. 2020. Changes in the amount of nutrient of packaged foods and beverages after the initial implementation of the Chilean Law of Food Labelling and Advertising: A nonexperimental prospective study. *PLoS Medicine*, 17(7), e1003220. https://doi.org/10.1371/journal.pmed.1003220

Roberto, C.A., Baik, J., Harris, J.L. & Brownell, K.D. 2010. Influence of licensed characters on children's taste and snack preferences. *Pediatrics*, 126(1):88-93. https://doi.org/10.1542/peds.2009-3433

Rodrigues, V.M., Rayner, M., Fernandes, A.C., de Oliveira, R.C., da Costa Proença, R.P. & Fiates, G.M.R. 2016. Comparison of the nutritional content of products, with and without nutrient claims, targeted at children in Brazil. *British Journal of Nutrition*, 115(11):2047-2056. https://doi.org/10.1017/S0007114516001021

Rossouw, H.A., Grant, C.C. & Viljoen, M. 2012. Overweight and obesity in children and adolescents: The South African problem. *South African Journal of Science*, 108(5-6):31-37. https://hdl.handle.net/10520/EJC120718

Ruiz-Roso, M.B., de Carvalho Padilha, P., Mantilla-Escalante, D.C., Ulloa, N., Brun, P., Acevedo-Correa, D., ... Dávalos, A. 2020. Covid-19 Confinement and Changes of Adolescent's Dietary Trends in Italy, Spain, Chile, Colombia and Brazil. *Nutrients*, 12(6), 1807. https://doi.org/10.3390/nu12061807

Rundle, A.G., Factor-Litvak, P., Suglia, S.F., Susser, E.S., Kezios, K.L., Lovasi, G.S., ... Link, B.G. 2020. Tracking of obesity in childhood into adulthood: effects on body mass index and fat mass index at age 50. *Childhood Obesity*, 16(3):226-233. https://doi.org/10.1089/chi.2019.0185

Sacks, G., Kwon, J., Vandevijvere, S. & Swinburn, B. 2021. Benchmarking as a Public Health Strategy for Creating Healthy Food Environments: An Evaluation of the INFORMAS Initiative (2012-2020). *Annual Review of Public Health*, 42(1):345-362. https://doi.org/10.1146/annurev-publhealth-100919-114442

Sadeghirad, B., Duhaney, T., Motaghipisheh, S., Campbell, N.R.C. & Johnston, B.C. 2016. Influence of unhealthy food and beverage marketing on children's dietary intake and preference: a systematic review and meta-analysis of randomized trials. *Obesity Reviews*, 17(10):945-959. https://doi-org.nwulib.nwu.ac.za/10.1111/obr.12445

Sanders, R.H., Han, A., Baker, J.S. & Cobley, S. 2015. Childhood obesity and its physical and psychological co-morbidities: a systematic review of Australian children and adolescents. *European Journal of Pediatrics*, 174(6):715-746. https://doi.org/10.1007/s00431-015-2551-3

Senekal, M., Nel, J.H., Malczyk, S., Drummond, L., Harbron, J. & Steyn, N.P. 2019. Provincial Dietary Intake Study (PDIS): Prevalence and Sociodemographic Determinants of the Double Burden of Malnutrition in A Representative Sample of 1 to Under 10-Year-Old

Children from Two Urbanized and Economically Active Provinces in South Africa. *International Journal of Environmental Research and Public Health*, 16(18), 3334. https://doi.org/10.3390/ijerph16183334

Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., ... SANHANES-1 Team. 2014. *The South African National Health and Nutrition Examination Survey, 2012: SANHANES-1*. Cape Town: HSRC Press.

Signal, L.N., Stanley, J., Smith, M., Barr, M.B., Chambers, T.J., Zhou, J., ... Ni Mhurchu, C. 2017. Children's everyday exposure to food marketing: an objective analysis using wearable cameras. *International Journal of Behavioral Nutrition and Physical Activity*, 14, 137. https://doi.org/10.1186/s12966-017-0570-3

Simmonds, M., Burch, J., Llewellyn, A., Griffiths, C., Yang, H., Owen, C., ... Woolacott, N. 2015. The use of measures of obesity in childhood for predicting obesity and the development of obesity-related diseases in adulthood: a systematic review and meta-analysis. *Health technology assessment (Winchester, England)*, 19(43):1-336. https://doi.org/10.3310/hta19430

Skaczkowski, G., Durkin, S., Kashima, Y. & Wakefield, M. 2016. The effect of packaging, branding and labeling on the experience of unhealthy food and drink: A review. *Appetite*, 99:219-234. https://doi.org/10.1016/j.appet.2016.01.022

Skinner, A.C., Perrin, E.M., Moss, L.A. & Skelton, J.A. 2015. Cardiometabolic risks and severity of obesity in children and young adults. *New England Journal of Medicine*, 373(14):1307-1317. https://doi.org/10.1056/nejmoa1502821

Smith, R., Kelly, B., Yeatman, H. & Boyland, E. 2019. Food Marketing Influences Children's Attitudes, Preferences and Consumption: A Systematic Critical Review. *Nutrients*, 11(4), 875. https://doi.org/10.3390/nu11040875

Sommer, A. & Twig, G. 2018. The Impact of Childhood and Adolescent Obesity on Cardiovascular Risk in Adulthood: a Systematic Review. *Current Diabetes Reports*, 18(10), 91. https://doi.org/10.1007/s11892-018-1062-9

Song, P., Zhang, Y., Yu, J., Zha, M., Zhu, Y., Rahimi, K. & Rudan, I. 2019. Global Prevalence of Hypertension in Children: A Systematic Review and Meta-analysis. *JAMA Pediatrics*, 173(12):1154-1163. https://doi.org/10.1001/jamapediatrics.2019.3310

Sonntag, D., Schneider, S., Mdege, N., Ali, S. & Schmidt, B. 2015. Beyond Food Promotion: A Systematic Review on the Influence of the Food Industry on Obesity-Related Dietary Behaviour among Children. *Nutrients*, 7(10):8565-8576. 5414. https://doi.org/10.3390/nu7105414

Steyn, N.P., Nel, J.H., Malczyk, S., Drummond, L. & Senekal, M. 2020. Provincial Dietary Intake Study (PDIS): Energy and Macronutrient Intakes of Children in a Representative/Random Sample of 1-<10-Year-Old Children in Two Economically Active and Urbanized Provinces in South Africa. *International Journal of Environmental Research and Public Health*, 17(5), 1717. http://dx.doi.org/10.3390/ijerph17051717

Stockwell, S., Trott, M., Tully, M., Shin, J., Barnett, Y., Butler, L., ... Smith, L. 2021. Changes in physical activity and sedentary behaviours from before to during the COVID-19 pandemic lockdown: a systematic review. *BMJ Open Sport & Exercise Medicine*, 7(1), e000960. http://dx.doi.org/10.1136/bmjsem-2020-000960

Storcksdieck genannt Bonsmann, S., Robinson, M., Wollgast, J. & Caldeira, S. 2019. The ineligibility of food products from across the EU for marketing to children according to two EU-level nutrient profile models. *PloS One*, 14(10), e0213512. https://doi.org/10.1371/journal.pone.0213512

Story, M. & French, S. 2004. Food advertising and marketing directed at children and adolescents in the US. *International Journal of Behavioral Nutrition and Physical Activity*, 1(3):1-17. https://doi.org/10.1186/1479-5868-1-3

Swinburn, B., Sacks, G., Vandevijvere, S., Kumanyika, S., Lobstein, T., Neal, B., ... INFORMAS. 2013. INFORMAS (International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support): overview and key principles. *Obesity Reviews*, 14(S1):1-12. https://doi-org.nwulib.nwu.ac.za/10.1111/obr.12087

Swinburn, B.A., Sacks, G., Hall, K.D., McPherson, K., Finegood, D.T., Moodie, M.L. & Gortmaker, S.L. 2011. The global obesity pandemic: shaped by global drivers and local environments. *Lancet*, 378(9793):804-814. https://doi.org/10.1016/S0140-6736(11)60813-1

Swinburn, B.A., Kraak, V.I., Allender, S., Atkins, V.J., Baker, P.I., Bogard, J.R., ... Devarajan, R. 2019. The global syndemic of obesity, undernutrition, and climate change: the Lancet Commission report. *Lancet*, 393(10173):791-846. https://doi.org/10.1016/S0140-6736(18)32822-8

Symington, E.A., Gericke, G.J., Nel, J.H. & Labadarios, D. 2016. The relationship between stunting and overweight among children from South Africa: Secondary analysis of the national food consumption survey-Fortification baseline I. *South African Medical Journal*, 106(1):65-69. https://hdl.handle.net/10520/EJC182763

Tatlow-Golden, M. & Garde, A. 2020. Digital food marketing to children: Exploitation, surveillance and rights violations. *Global Food Security*, 27, 100423. https://doi.org/10.1016/j.gfs.2020.100423

Templin, T., Cravo Oliveira Hashiguchi, T., Thomson, B., Dieleman, J. & Bendavid, E. 2019. The overweight and obesity transition from the wealthy to the poor in low- and middle-income countries: A survey of household data from 103 countries. *PLoS Medicine*, 16(11), e1002968. https://doi.org/10.1371/journal.pmed.1002968

Teng, H., Hu, J., Ge, W., Dai, Q., Liu, J., Xiao, C., ... Zhu, X. 2021. Body Mass Index Trajectories during 6-18 Years Old and the Risk of Hypertension in Young Adult: A Longitudinal Study in Chinese Population. *International Journal of Hypertension*, 2021, 6646868. https://doi.org/10.1155/2021/6646868

Tzioumis, E. & Adair, L.S. 2014. Childhood dual burden of under- and overnutrition in low- and middle-income countries: a critical review. *Food and nutrition bulletin*, 35(2):230-243.

Umer, A., Kelley, G.A., Cottrell, L.E., Giacobbi, P.J., Innes, K.E. & Lilly, C.L. 2017. Childhood obesity and adult cardiovascular disease risk factors: a systematic review with meta-analysis. *BMC Public Health*, 17(1):683-683. https://doi.org/10.1186/s12889-017-4691-z

UNICEF (United Nations Children's Fund), WHO (World Health Organization) & World Bank Group. 2021. *Levels and trends in child malnutrition: key findings of the 2021 edition of the*

joint child malnutrition estimates. https://apps.who.int/iris/handle/10665/341135 Date of access: 15 September 2021.

Visser, M., Van Zyl, T., Hanekom, S.M., Baumgartner, J., van der Hoeven, M., Taljaard-Krugell, C., ... Faber, M. 2019. Nutrient patterns and their relation to anemia and iron status in 5- to 12-y-old children in South Africa. *Nutrition*, 62:194-200. https://doi.org/10.1016/j.nut.2019.01.016

Visser, M., Van Zyl, T., Hanekom, S.M., Baumgartner, J., Van der Hoeven, M., Taljaard-Krugell, C., ... Faber, M. 2021. Nutrient density, but not cost of diet, is associated with anemia and iron deficiency in school-age children in South Africa. *Nutrition*, 84, 111096. https://doi.org/10.1016/j.nut.2020.111096

Vorster, H.H., Kruger, A., Wentzel-Viljoen, E., Kruger, H.S. & Margetts, B.M. 2014. Added sugar intake in South Africa: findings from the Adult Prospective Urban and Rural Epidemiology cohort study. *The American Journal of Clinical Nutrition*, 99(6):1479-1486. https://doi-org.nwulib.nwu.ac.za/10.3945/ajcn.113.069005

Ward, Z.J., Long, M.W., Resch, S.C., Giles, C.M., Cradock, A.L. & Gortmaker, S.L. 2017. Simulation of Growth Trajectories of Childhood Obesity into Adulthood. *New England Journal of Medicine*, 377(22):2145-2153. https://doi.org/10.1056/nejmoa1703860

Wentzel-Viljoen, E., Lee, S., Laubscher, R. & Vorster, H.H. 2018. Accelerated nutrition transition in the North West Province of South Africa: results from the Prospective Urban and Rural Epidemiology (PURE-NWP-SA) cohort study, 2005 to 2010. *Public Health Nutrition*, 21(14):2630-2641. https://doi.org/10.1017/S1368980018001118

WHO (World Health Organization). 2010. *Set of recommendations on the marketing of foods and non-alcoholic beverages to children*. http://apps.who.int/iris/bitstream/handle/10665/44416/9789241500210_eng.pdf?sequence=1 Date of access: 24 June 2018.

WHO (World Health Organization). 2013. *Global action plan for the prevention and control of noncommunicable diseases 2013-2020*. http://apps.who.int/iris/bitstream/handle/10665/94384/9789241506236_eng.pdf?sequence=1 Date of access: 8 June 2018.

WHO (World Health Organization). 2014. *Comprehensive implementation plan on maternal, infant and young child nutrition*. http://apps.who.int/iris/bitstream/handle/10665/113048/WHO_NMH_NHD_14.1_eng.pdf?ua=1 Date of access: 8 June 2018.

WHO (World Health Organization). 2016a. *Tackling food marketing to children in a digital world: trans-disciplinary perspectives*. https://www.euro.who.int/__data/assets/pdf_file/0017/322226/Tackling-food-marketing-children-digital-world-trans-disciplinary-perspectives-en.pdf Date of access: 27 September 2021.

WHO (World Health Organization). 2016b. *Report of the Commission on Ending Childhood Obesity*. http://apps.who.int/iris/bitstream/handle/10665/204176/9789241510066_eng.pdf Date of access: 12 October 2019.

WHO (World Health Organization). 2020. *Global Health Estimates 2020: Deaths by Cause, Age, Sex, by Country and by Region, 2000-2019*. (World Health Organization). https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death Date of access: 12 November 2021.

Wicks, M., Wright, H. & Wentzel-Viljoen, E. 2017. Restricting the marketing of foods and non-alcoholic beverages to children in South Africa: are all nutrient profiling models the same? *British Journal of Nutrition*, 116(12):2150-2159. https://doi.org/10.1017/S0007114516004244

Wiles, N.L. 2017. The nutritional quality of South African ready-to-eat breakfast cereals. *South African Journal of Clinical Nutrition*, 30(4):8-16. https://doi.org/10.1080/16070658.2017.1319124

Zemrani, B., Gehri, M., Masserey, E., Knob, C. & Pellaton, R. 2021. A hidden side of the COVID-19 pandemic in children: the double burden of undernutrition and overnutrition. *International Journal for Equity in Health*, 20(1):1-4. https://doi.org/10.1186/s12939-021-01390-w

CHAPTER 3 MANUSCRIPT

The manuscript is formatted according to the guidelines of Public Health Nutrition, with exception of the font and line numbers which will be inserted before submission (Annexure E).

Food marketing to children in South African supermarkets: What techniques are used and what type of foods are promoted?

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Abstract

Objective: To investigate the extent and nature of marketing techniques used on the packaging of child-orientated foods in South African supermarkets and to determine the healthiness of these foods.

Design: This was a cross sectional observational study where child-orientated packaged food and non-alcoholic beverages were identified and photographed on all sides. Photographs were analysed and data regarding promotional characters, premium offers, claims, and nutritional information per 100 g were extracted. The foods were categorised according to the food group classification system of the Global Food Monitoring Group. The foods were classified using the South African nutrient profiling model (SANPM) to determine their healthiness. Descriptive statistics were used to determine the amount and type of marketing techniques used and to describe the application of these techniques on healthy versus unhealthy foods.

Setting: Four retail outlets (three supermarkets and one online store) in Pretoria, South Africa.

Results: A total of 477 foods were included in the study with the majority of foods (61%) being unhealthy. The most common child-orientated foods were confectionaries (33%), cereal and cereal products (16%), dairy (13%) and non-alcoholic beverages (11%). All three marketing techniques were used to market predominantly unhealthy foods to children. Promotional characters were present on 453 (95%) of foods with majority using cartoon characters/company-owned characters and 'for kids'/child-associated promotional characters.

Conclusion: The majority of foods marketed to children in the included South African supermarkets were unhealthy and the marketing technique most often used to promote these foods were promotional characters.

Keywords:

Food marketing; Children; Food packaging; Nutritional profile; South Africa; Premium offers; Promotional characters

1. Introduction

The obesogenic food environment, specifically the marketing of unhealthy foods to children, is recognised as a key contributing factor to the current childhood obesity epidemic. Childhood overweight and obesity is of particular concern in low- and middle-income countries (LMICs), including South Africa, where the prevalence of childhood obesity is rising rapidly amid an existing high prevalence of undernutrition[1, 2]. The result is a double burden of malnutrition where over- and undernutrition co-exist in individuals, households, or communities.

Evidence shows that the food industry is driving obesity through an increased availability of ultra-processed foods (UPFs) and the extensive marketing of these foods to children, leading to obesogenic food environments[3, 4]. UPFs are considered unhealthy and refers to food that are made from processed ingredients that have been extracted from whole foods and are mostly energy-dense, high in fat, salt and/or sugar (HFSS) and low in beneficial nutrients such as protein, dietary fibre and micronutrients[5]. Examples of UPFs include, confectionaries, cereal bars, breakfast cereals, carbonated and sugar-sweetened drinks, biscuits and savoury snacks such as crisps. Besides possibly displacing nutrient-dense foods and putting children at risk of micronutrient deficiencies[6], UPFs are highly palatable, and the consumption of these foods has been shown to increase energy intake[7] and is associated with a higher body mass index (BMI)[8].

The globalisation of the food system contributed to the nutrition transition that many LMICs are now facing, characterised by a shift away from traditional, minimally processed food towards a diet that predominantly consists of UPFs[9]. The nutrition transition is also present among South African children with research indicating an increased intake of energy-dense foods high in salt and sugar and a lower intake of nutrient-dense foods playing a vital part in healthy diets such as fruit, vegetables and legumes[10, 11].

The marketing of foods to children is extensive[12] and spans across a range of marketing mediums such as television, packaging and digital games[13]. Food marketing, especially that of unhealthy food, can significantly influence children's attitude, preference, and consumption of food[14-16]. Children are only able to understand the persuasive intent of marketing from around 12 years of age, making them exceptionally vulnerable to marketing of foods[17]. Additionally, most children lack the skills to accurately interpret the labels of food to evaluate its healthiness and relies heavily on visual and associative cues involving colours, images, spokes-characters, brands and claims[18]. Exposing children to an environment that consistently motivates them to consume unhealthy food raises concerns regarding the long-term effects of the food environment on their diet and wellbeing.

The packaging of foods is a particularly powerful marketing medium. In addition to its purpose to convey information to consumers, it is also present when food is purchased and consumed[19]. Numerous studies have found that children are predominantly exposed to the marketing of unhealthy foods and that fruit and vegetables were less likely to be marketed to children using packaging[20, 21]. Rodrigues *et al.*[22] showed that child-orientated foods with nutrient claims had either a similar or worse nutritional content than their counterparts without nutrient claims.

Food packaging has been shown to influence children's perception[23], consumption[14], taste[24] and preference[25] for a certain food. Moreover, children from different income levels perceive food labels differently. Children from low-income households may be more vulnerable to the marketing of packaged foods because they attach more importance to the social status and desirability associated with the food[23]. Techniques such as the use of licensed characters, cartoon characters, claims, premium offers, themes of fantasy and fun, action-adventure, bright colours, unusual product names and flavours, and using child-associative words are often used by marketers to target children and entice them to purchase these foods[13].

A need to create food environments that enable healthy eating is evident. Due to the role that the marketing of unhealthy foods to children play in the obesity epidemic, restrictions are required[26]. As a result, the World Health Organization (WHO) urged Member States to impose restrictions on the marketing of unhealthy foods to children, as a strategy to combat childhood obesity[27, 28]. They recommend identifying current information regarding the extent, nature and the effects of food marketed to children and supporting further research to get baseline data that will assist with policy development and implementation. In 2014, the South African National Department of Health (SANDoH) Directorate: Food Control, published a draft regulation for comments (Regulation 429 of the Foodstuffs, Cosmetics and Disinfectants Act No. 54 of 1972), that aim to restrict the marketing of unhealthy foods to children[29]. This regulation can assist in creating a food environment that enables children to make healthier food choices, but it is yet to be promulgated.

In South Africa, limited information regarding the healthiness of child-orientated foods exists. Wiles[30] investigated packaged foods in supermarkets but the study was limited to the breakfast cereals category only, while Mchiza *et al.*[31] and Wicks *et al.*[32] examined child-orientated foods advertised to children on television. They all found that child-orientated foods have poor nutritional profiles. Both Wiles and Mchiza *et al.* reported on the claims

used to promote foods and Mchiza *et al.* also included the type of presenter used in television advertisements, but no other marketing techniques were investigated. Wiles found that 85.7% of child-orientated breakfast cereals contained a nutrient claim. However, Mchiza *et al.* found that of all food-related advertisements shown (both child-orientated and non-child-orientated), only 11% contained an explicit health claim. Additionally, their findings indicated that 2% of all television advertisements contained cartoons as presenters. There is thus truly little known about the healthiness of foods and the marketing techniques used to target children in South African supermarkets.

The aim of this study was to investigate the nature and extent of marketing on the packaging of all child-orientated foods in South African supermarkets and to determine the healthiness of these foods.

2. Methods

The methods used for this study are based on the International Network for Food and Obesity / NCD Research, Monitoring and Action Support (INFORMAS) Food Labelling protocol [33].

2.1. Sampling of supermarkets

Shoprite, Spar, Pick 'n Pay and Woolworths were identified as the four largest retail chains in South Africa according to revenue generated[34]. One supermarket from each retail chain within Pretoria, Gauteng were randomly selected for data collection. These retailers serve different income groups and are therefore considered to be a good representation of all foods available to the various income groups in South Africa.

2.2. Selection of child-orientated foods

All child-orientated foods in supermarkets were included for selection. Foods aimed at infants were excluded and accordingly, foods within the baby aisle were not captured. Alcoholic beverages, coffee, and vitamins and mineral foods were also excluded.

For the purpose of this study, children were defined as a child between the ages of 1 and 18 years [28]. Child-orientated foods were defined, using definitions of similar studies[35, 36], as a food of which the packaging contains *two or more* of the following:

- Pictures or cartoon images appealing to children.
- Specific or unusual shapes, colours, sizes or other iconography as well as the foregrounding or emphasis of any of these factors.
- Language, direct words or allusions referring to children, fun, play or school.

- Puzzles, games and premium offers such as competitions, toys, giveaways targeted at children.
- Cross-promotions or tie-ins with films, children's television programmes, celebrities, games, merchandise, websites and sports teams.
- Nutrient, health or health-related claims on the packaging.

2.3. Data collection

Permission to collect data in-store was granted from the supermarket managers of three retailers and data from the fourth retailer, who denied permission to capture data in-store, was captured using their online store. Data was captured from March 2020 to January 2021. Foods that met the child-orientated criteria were included and photographed. Additional information regarding premium offers that were not on the food label (such as price discounts, etc.), were also noted in-store and on the online store.

Two flavours per food and only the smallest available size of a food was included. Each flavour was included as a separate food item and when more than two flavours were available, the most common flavour (i.e. vanilla, chocolate, strawberry etc.) and the most unusual flavour (sour strawberry, tropical etc.) were included. Foods that were sold in more than one supermarket were only included once.

The photos were analysed and information regarding the following labelling components were extracted and entered into electronic data sheets in Microsoft® Excel:

- Product information such as the product name, manufacturer, etc.
- Marketing techniques including nutrition, health or health-related claims, promotional characters and premium offers. The type of promotional characters and premium offers were identified and coded.
- Nutrient information for priority nutrients (energy, protein, total sugar, saturated fat, fibre and sodium) per 100 g/100 ml from the nutrient information panel (NIP).
- Quantitative Ingredient Declaration (QUID) for priority ingredients (fruit, vegetables, legumes and nuts) from the ingredient list.

With regard to data collection from the online store, images of the food on the website were used to collect data. The information on the product page was seen as part of the food packaging and data from the food description, NIP and ingredient lists sections were included.

All foods were then sorted into their respective food categories, according to the Global Food Monitoring Group classification system. Queries or discrepancies arising during data

collection and the coding process were flagged, and all duplicate foods were removed. The flagged discrepancies mainly involved the inclusion or exclusion of food and selecting the appropriate food category and codes. A second researcher checked the flagged data (46.2% of the included data) to resolve these discrepancies. When uncertainty existed regarding the inclusion of foods, the researcher referred back to the INFORMAS protocol classification codes for promotional characters or premium offers. Foods displaying any child-associated words such as “happy”, “smile”, “fantastical” and “yay”, were interpreted as ‘for kids’ and included. Furthermore, if the food could fit into any of the INFORMAS protocol classification codes, it was also included.

2.4. Determining the healthiness of the included foods

The healthiness of all foods was determined by applying the South African nutrient profiling model (SANPM)[29]. Foods that did not have a NIP on its label (6.5%) were classified based on the nutritional information sourced from comparable foods.

2.5. Statistical Analysis

Descriptive analysis was used to determine (i) the extent of child-orientated foods, (ii) the type and amount of marketing techniques used, specifically promotional characters, premium offers and claims, (iii) the healthiness of the foods and finally, (iv) the use of marketing techniques on healthy versus unhealthy foods.

3. Results

Overall, information of 632 foods were captured where after 155 (24.5%) foods were excluded by Researcher 2 for not meeting the pre-defined criteria of child-orientated foods. Finally, a total of 477 child-orientated foods were included in the study. The number of foods per category is illustrated in Figure 1. The categories with the greatest number of child-orientated foods were confectionaries, cereal and cereal products, dairy and non-alcoholic beverages. No foods from the edible oils and oil emulsions, eggs, fish and seafood, special foods, and fresh meat and meat alternatives categories were found to be marketed to children.

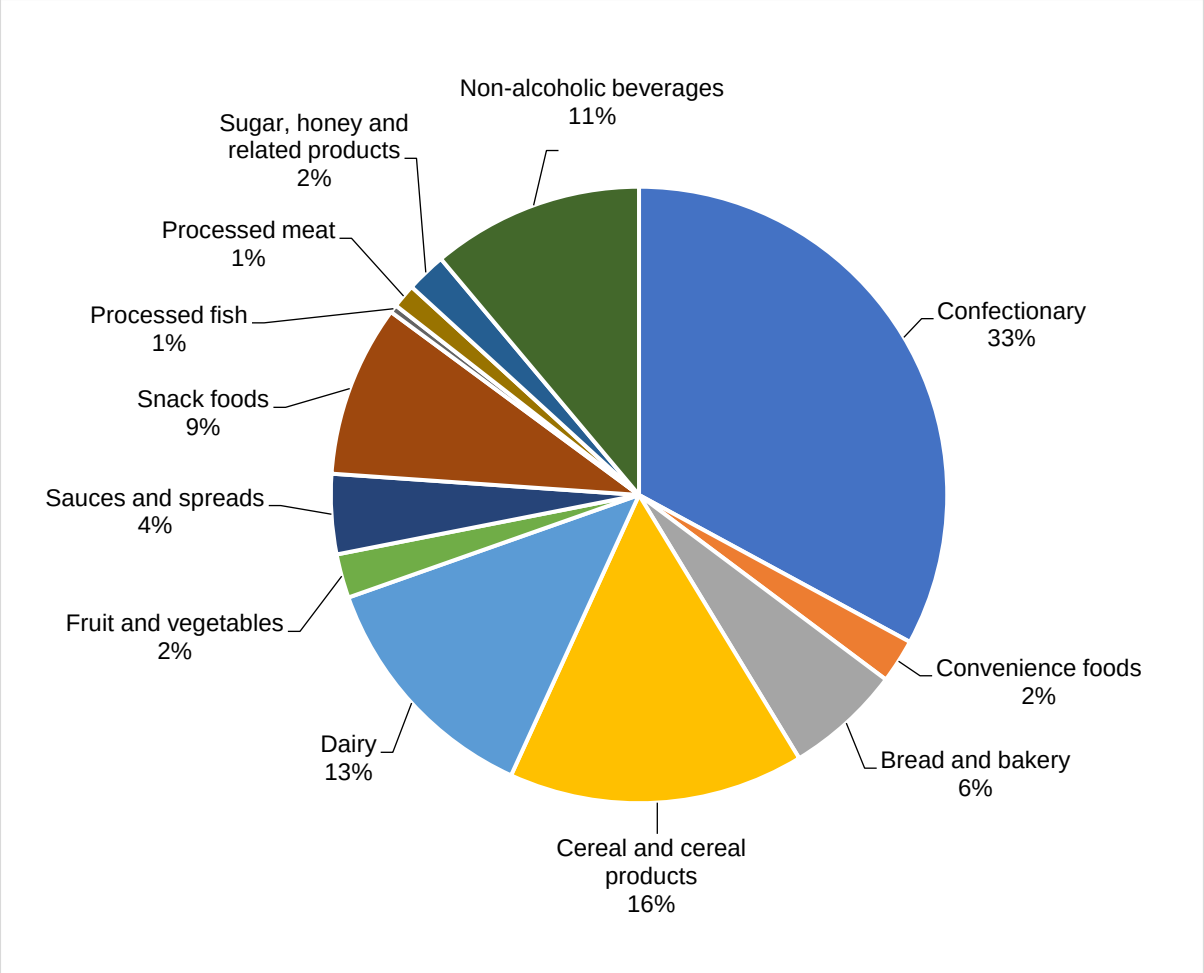


Figure 1 Food categories marketed to children (Supermarkets in Pretoria, South Africa, 2020-2021).

Of the included foods, 95% contained promotional characters, 63.3% contained claims and 28.9% contained premium offers. As illustrated in Figure 2, categories with the most promotional characters were confectionaries, cereal and cereal products, and dairy. In total 15.7% (*n* 75) of the foods contained more than one type of promotional character whereas only 2.0% (*n* 10) of foods had more than one type of premium offer. Of the included foods, 23.8% (*n* 114) contained both a promotional character and premium offer.

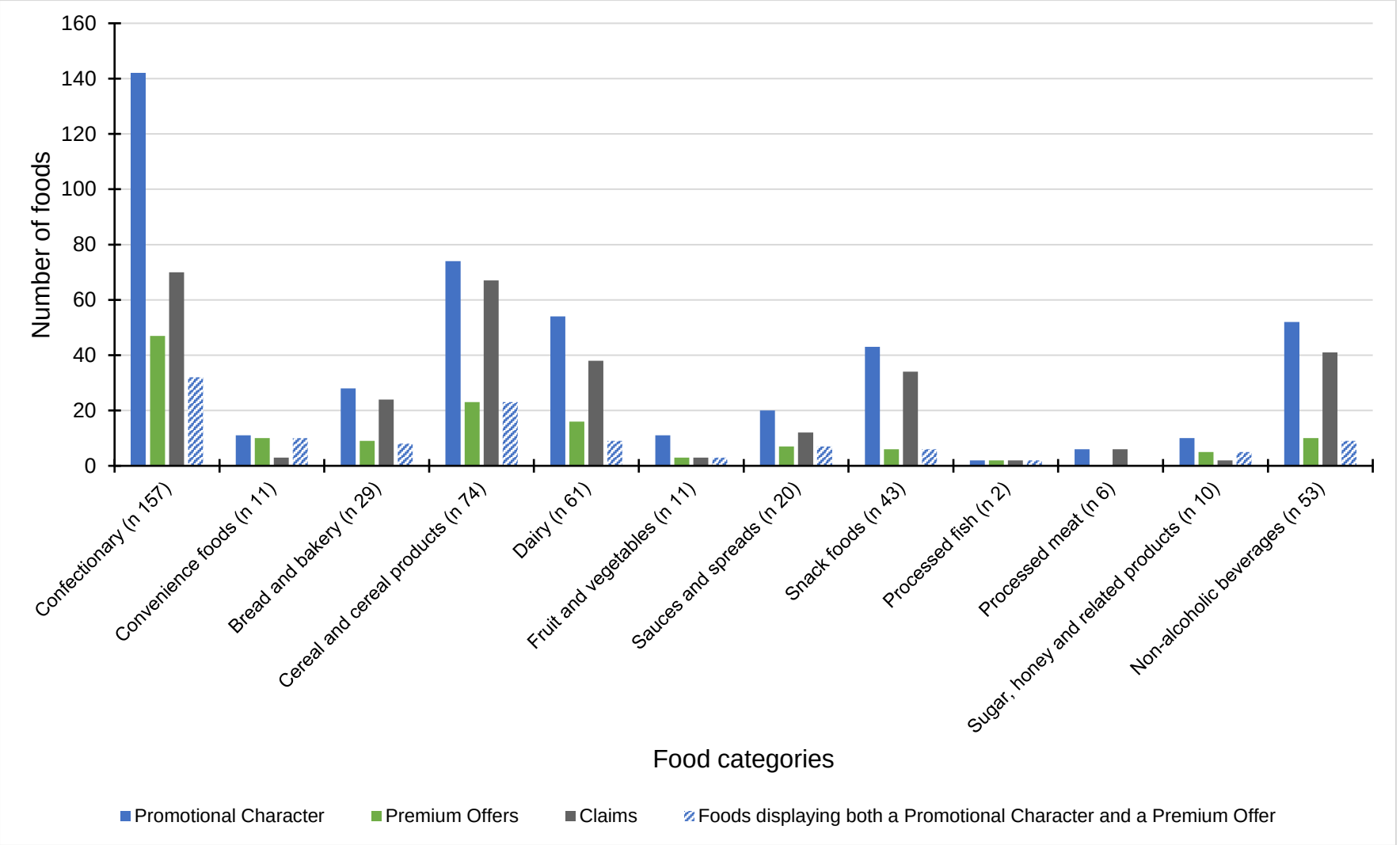


Figure 2 Marketing techniques used on child-orientated food packaging per food category (Supermarkets in Pretoria, South Africa, 2020-2021).

The frequency of the different types of promotional characters and premium offers used, is displayed in Table 1. The two types of promotional characters most often used were cartoons/company-owned characters and 'for kids'/child-associated promotional characters.

Table 1 Type of promotional characters and premium offers present on child-orientated foods (Supermarkets in Pretoria, South Africa, 2020-2021).

Types of promotional characters	Total number of promotional characters (*n 528*)	
	n	%
Cartoon/Company owned character	313	59.3
Licenced character	16	3.0
Amateur sportsperson	0	0.0
Celebrity (non-sport)	0	0.0
Movie tie-in	3	0.6
Famous sportsperson/team	8	1.5
Non-sport/historical event/festival	0	0.0
'For kids'/child-associated	182	34.5
Awards	3	0.6
Sport events	3	0.6
Types of premium offers	Total number of premium offers (*n* 150)	
	n	%
Game and app downloads	30	20.0
Contests	15	10.0
Pay 2 take 3 or other	47	31.3
20% extra or other	1	0.7
Limited edition	3	2.0
Social charity	7	4.7
Gift or collectable	3	2.0
Price discount	40	26.7
Retail loyalty programmes	4	2.7

With regard to premium offers, the pay 2 take 3 or similar, price discounts, and games and app downloads were most often used. The game and app downloads include games on the food packaging itself or any messaging that refers children to other sources of fun and games such as websites and social media.

Classification of the healthiness of foods

The majority of the included foods were classified as unhealthy (61%). Figure 3 illustrates the healthiness of foods per food category. Categories consisting of the least healthy foods were confectionaries (96.8%), bread and bakery products (86.2%), snack foods (86.0%), and sugar, honey, and related products (80%). Categories with the healthiest foods were, convenience

foods (mostly ready-to-eat meals) (100%), processed fish (100%), sauces and spreads (95%) and non-alcoholic beverages (mostly fruit juices and dairy-based drinks) (90.6%).

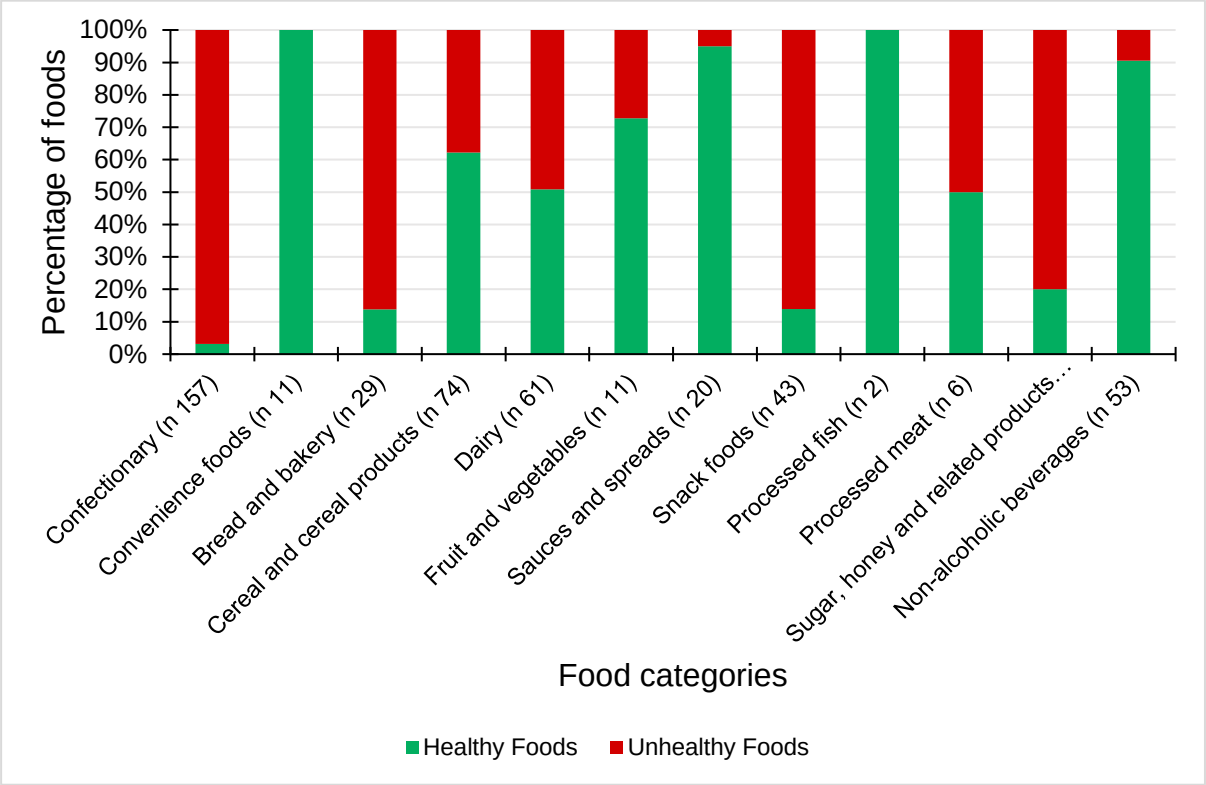


Figure 3 Healthiness of child-orientated foods per food category, as determined by the South African nutrient profiling model (SANPM) (Supermarkets in Pretoria, South Africa, 2020-2021).

Comparison of marketing techniques used on healthy versus unhealthy foods

Figure 4 shows the healthiness of foods with promotional characters, premium offers, and claims. This study found that the majority of foods containing promotional characters (60%), premium offers (58%) and claims (56.3%) were classified as unhealthy. Promotional characters were used most often for the marketing of unhealthy foods.

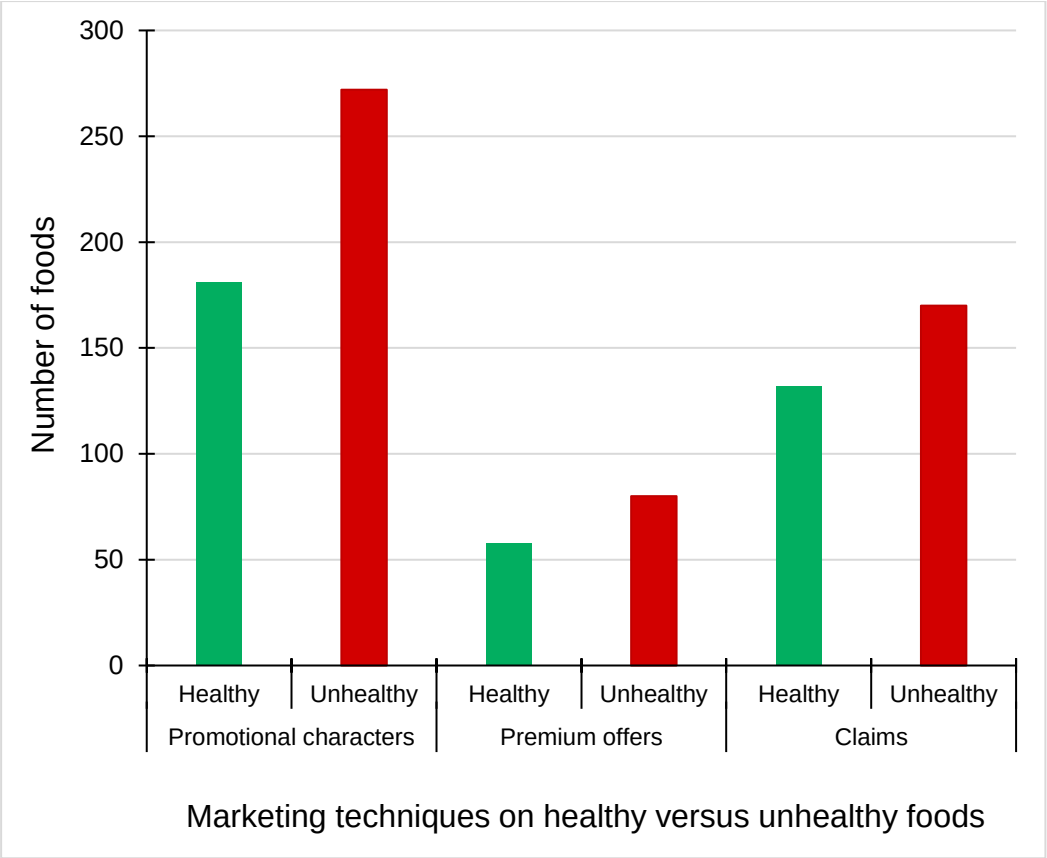


Figure 4 The healthiness of child-orientated foods per marketing technique, as determined by the South African nutrient profiling model (SANPM) (Supermarkets in Pretoria, South Africa, 2020-2021).

4. Discussion

This study provides an overview of the marketing techniques used on child-orientated food and the healthiness of these foods sold in urban South African supermarkets. To our knowledge, this is the first study to examine child-orientated foods across a variety of food categories in South African supermarkets.

We found that the majority (61.2%) of child-orientated foods in South African supermarkets are unhealthy and that foods from the confectionary food category are most frequently marketed to children (33%) with 96.8% of food in this category being classified as unhealthy according to the SANPM. In contrast, only 2% of all foods marketed to children are from the fruit and vegetables category. Previous studies investigating food marketing to children in South Africa also reported that child-orientated foods had poor nutritional profiles[30, 32]. Wicks *et al.*[32] and Mchiza *et al.*[31] found that most food advertisements on television during children's viewing time, promoted HFSS foods and sweets and desserts, respectively. Findings from other international studies agree that most foods marketed to children in supermarkets are from food categories similar to

confectionaries, breakfast cereals and dairy and that very little, if any, fruit and vegetables are marketed to children in supermarkets[13, 21, 22, 37].

The findings in South Africa are similar to findings from Slovenia[20], Guatemala[38], Canada[39] and Chile[40] which all reported the majority of child-orientated foods to be unhealthy. However, apart from Chile, the studies from the other countries reported a greater percentage of unhealthy child-orientated foods compared to this study, with 93%, 97.1% and 88.2% unhealthy foods, respectively. This shows that the marketing of unhealthy foods to children is an international challenge and supports the WHO's call for improved food environments. The reason for the difference in results could be the use of different nutrient profiling models. The study from Slovenia[20] and Canada[39] both used the WHO Regional Office for Europe nutrient profiling model whereas the study from Guatemala[38] used the United Kingdom Office of Communications (OFCOM) nutrient profiling model. The reason for this difference could also be the inclusion of different types of foods by these studies, for example, the Guatemalan study[38] only included Child-orientated snack foods.

There are, however, some discrepancies regarding the healthiness of some food categories. With regard to breakfast cereals, studies from New Zealand[41] and Slovenia[20] reported that most child-orientated breakfast cereals were classified unhealthy (58% and 98%, respectively). In contrast, we found that most breakfast cereals are classified as healthy according to the SANPM. The difference in results could be explained by the use of different nutrient profiling models used to classify the healthiness of foods. Furthermore, Wiles[30] analysed breakfast cereals in South African supermarkets and found that child-orientated breakfast cereals were more likely to contain a higher carbohydrate, sugar and sodium content and a lower protein and fibre content per 100 g, than non-child-orientated cereals. Unfortunately, Wiles did not determine the healthiness of the breakfast cereals using a nutrient profiling model to make the results of the studies directly comparable. However, in 2013, the SANDoH introduced regulation 214 (R 214) of the Foodstuffs, Cosmetics and Disinfectants Act No. 54 of 1972, aiming to reduce the sodium content in processed foods[42]. As a result of the introduction of R 214 and the movement towards the possible regulation of the marketing of foods to children, many food manufacturers have possibly started the reformulation of their products, resulting in a lower added sugar and sodium content and a higher protein and fibre content of these foods. This change, as well as the fact that the SANPM was used for healthiness classification in our study, could explain the difference in findings.

The majority of the child-orientated non-alcoholic beverages were classified as healthy according to the SANPM in this study while the study from Slovenia[20] reported that the majority of the juices, milk drinks and other beverages included in their study were unhealthy. This

difference in healthiness classification could possibly be explained by the large amount of 100% fruit and vegetable juices and cordials containing fruit juices included in our study. The SANPM classifies 100% pure fruit and vegetable juices as healthier foods. Furthermore, it was noted that the sugar content of the soft drinks and cordials in this study was lower than expected and ingredient lists revealed these beverages contained non-nutritive sweeteners. The use of non-nutritive sweeteners in child-orientated foods as strategies for obesity prevention, is questionable. The SANPM does not take non-nutritive sweeteners into account, thus a decrease in sugar content of a food will result in a better healthiness score despite the use of non-nutritive sweeteners. Of note, our study found almost all convenience food marketed to children were ready-to-eat meals that resembles home-cooked meals such as cottage pie and spaghetti Bolognese and these foods contained vegetables. This explains why nearly all convenience foods in this study were classified as healthy.

This study found that marketing techniques are used to market primarily unhealthy foods to children. Promotional characters are the most frequently used marketing technique on child-orientated foods with 95% of all foods containing a promotional character. The type of promotional characters used most frequently, were cartoon characters/company owned characters and 'for kids'/child-associated promotional characters. Promotional characters of the 'for kids'/child-associated category comprised of characters that specifically referred to children, fun or school, for example an 'ideal-for-lunch-boxes' illustration on the packaging or an image of a child's fingers holding the food. These findings are concerning since research indicates that the marketing of unhealthy foods to children can increase their consumption and preference for these foods[16]. Promotional characters such as cartoon media characters and brand equity characters can draw more attention from children, increase purchasing requests for a specific food and influence food preferences, especially for energy-dense foods[25, 43, 44]. Children find cartoon characters on food packaging funnier and less boring than foods without any characters[23]. Moreover, promotional characters can foster an emotional bond with children that increase brand recognition and trust[44].

Our findings indicated that most child-orientated foods contained a claim on the packaging. This is slightly more than a study from Brazil, that showed 50.5% of the included child-orientated foods in a Brazilian supermarket contained a claim[22]. It is also concerning that 56.3% of foods containing a claim in this study, were classified as unhealthy by the SANPM. The literature shows that parents use claims to evaluate the healthiness of foods and view foods with claims as healthier [45]. This can mislead parents to think they are providing their child with a healthier food.

The result of this study shows that food marketing in South African supermarkets do not support children in making healthier choices. Instead, predominantly exposing children to the marketing of unhealthy foods can put children at risk of negative health consequences. Many South African children are consuming a diet with little dietary diversity and high in refined foods and added sugars, contributing to most children not meeting their daily fibre requirements[11]. A diet high in energy-dense foods and low in nutrient-dense foods can place children at risk of weight gain[8] and micronutrient deficiencies, such as iron deficiency[6]. Additionally, the lack of marketing of fruit and vegetables to children is a missed opportunity to encourage children to improve their diets. Literature shows that children respond better to visual aspects of packaging and that they perceive fruit and vegetables as healthier and tastier when it contains more information on the packaging[46].

The extent to which unhealthy foods are marketed to children is of great concern. In view of the rising childhood obesity prevalence in South Africa, regulations to restrict the marketing of unhealthy foods to children are required. In 2016, Chile implemented the Law of Food Labelling and Advertising (Law 20.606) that restricts the marketing of unhealthy foods containing excess amounts of energy, saturated fat, total sugar and sodium to children and requiring these foods to carry a warning indicating it is high in the specific nutrient[47]. Early research already shows reformulation of foods and a subsequent improvement in the nutritional composition of foods, specifically a decrease in the sugar and sodium content of packaged foods and beverages[48]. Regulations can thus play a supporting role in creating healthier food environments for children.

Limitations

A limitation of this study is that data was only collected in urban areas from large retailers, therefore excluding smaller retail outlets and informal vendors in rural areas that might expose children to different foods. Additionally, only three marketing techniques were evaluated, namely promotional characters, premium offers and claims. Including more marketing techniques such as colours, packaging size and the types of claims used, would allow for a more comprehensive understanding of the marketing that children are exposed to and would allow for future studies to evaluate the effectiveness of any regulations. We only analysed the packaging of foods and did not include digital marketing mediums such as social media and websites (other than the product pages of the online store). Given the extensive use and the pervasive nature of digital marketing[49], it is important to investigate these mediums as well.

Another limitation of this study is the use of only one nutrient profiling model to classify the healthiness of foods. The SANPM has been validated for the use of classifying child-orientated foods, especially because it allows certain dairy foods to be marketed to children[32]. But the

authors showed that there are substantial differences in the results of different nutrient profiling models when used to classify the healthiness of child-orientated foods[32]. They recommend including non-nutritive sweetener in the criterion, especially when analysing highly processed foods that are included by the SANPM due to lower sugar contents. Recently, a different nutrient profiling model, based on the 2019 Chilean nutrient profile, was suggested for restrictive marketing regulations in South Africa such as child-orientated marketing regulations[50]. It would thus be useful to classify the foods in this study using different nutrient profiling models to better understand the healthiness of child-orientated foods. Lastly, this study only included child-orientated foods and excluded all other foods and therefore no comparison can be made between the amount and types of foods, the marketing techniques and the healthiness of child-orientated foods versus non-child-orientated foods. Other studies have been able to make such comparisons and found that child-orientated foods had consistently worse nutritional profiles than non-child foods[20, 22]. It can therefore be valuable to include all foods in supermarkets.

5. Conclusion

In conclusion, we found most child-orientated foods in South African supermarkets are unhealthy. Marketing techniques such as promotional characters, premium offers and claims are also mainly used to market unhealthy foods to children. This study shows the need for implementing marketing restrictions to create more favourable food environments that will support children in making healthier food choices.

References

1. L.B.D. Double Burden of Malnutrition Collaborators (2020) Mapping local patterns of childhood overweight and wasting in low- and middle-income countries between 2000 and 2017. *Nat Med* 26, 750-759.

2. Monyeki MA, Awotidebe A, Strydom GL *et al.* (2015) The challenges of underweight and overweight in South African children: are we winning or losing the battle? A systematic review. *Int J Environ Res Public Health* 12, 1156-1173.

3. Swinburn BA, Sacks G, Hall KD *et al.* (2011) The global obesity pandemic: shaped by global drivers and local environments. *Lancet* 378, 804-814.

4. Sonntag D, Schneider S, Mdege N *et al.* (2015) Beyond Food Promotion: A Systematic Review on the Influence of the Food Industry on Obesity-Related Dietary Behaviour among Children. *Nutrients* 7, 8565-8576.

5. Monteiro CA, Moubarac JC, Cannon G *et al.* (2013) Ultra-processed products are becoming dominant in the global food system. *Obes Rev* 14, 21-28.

6. Visser M, Van Zyl T, Hanekom SM *et al.* (2021) Nutrient density, but not cost of diet, is associated with anemia and iron deficiency in school-age children in South Africa. *Nutrition* 84, 111096.

7. Hall KD, Ayuketah A, Brychta R *et al.* (2019) Ultra-Processed Diets Cause Excess Calorie Intake and Weight Gain: An Inpatient Randomized Controlled Trial of Ad Libitum Food Intake. *Cell Metab* 30, 67-77.e63.

8. Louzada MLdC, Baraldi LG, Steele EM *et al.* (2015) Consumption of ultra-processed foods and obesity in Brazilian adolescents and adults. *Prev Med* 81, 9-15.

9. Baker P, Machado P, Santos T *et al.* (2020) Ultra-processed foods and the nutrition transition: Global, regional and national trends, food systems transformations and political economy drivers. *Obes Rev* 21, e13126.

10. Feeley A, Musenge E, Pettifor JM *et al.* (2012) Changes in dietary habits and eating practices in adolescents living in urban South Africa: The birth to twenty cohort. *Nutrition* 28, e1-e6.

11. Steyn NP, Nel JH, Malczyk S *et al.* (2020) Provincial Dietary Intake Study (PDIS): Energy and Macronutrient Intakes of Children in a Representative/Random Sample of 1-<10-Year-Old Children in Two Economically Active and Urbanized Provinces in South Africa. *Int J Environ Res Public Health* 17, 1717.

12. Boyland EJ & Whalen R (2015) Food advertising to children and its effects on diet: review of recent prevalence and impact data. *Pediatr Diabetes* 16, 331-337.

13. Cairns G, Angus K, Hastings G *et al.* (2013) Systematic reviews of the evidence on the nature, extent and effects of food marketing to children. A retrospective summary. *Appetite* 62, 209-215.

14. Boyland EJ, Nolan S, Kelly B *et al.* (2016) Advertising as a cue to consume: a systematic review and meta-analysis of the effects of acute exposure to unhealthy food and nonalcoholic beverage advertising on intake in children and adults. *Am J of Clin Nutr* 103, 519-533.

15. Smith R, Kelly B, Yeatman H *et al.* (2019) Food Marketing Influences Children's Attitudes, Preferences and Consumption: A Systematic Critical Review. *Nutrients* 11.

16. Sadeghirad B, Duhaney T, Motaghipisheh S *et al.* (2016) Influence of unhealthy food and beverage marketing on children's dietary intake and preference: a systematic review and meta-analysis of randomized trials. *Obes Rev* 17, 945-959.

17. Carter OBJ, Patterson LJ, Donovan RJ *et al.* (2011) Children's understanding of the selling versus persuasive intent of junk food advertising: Implications for regulation. *Soc Sci & Med* 72, 962-968.

18. Elliott C & Brierley M (2012) Healthy choice?: Exploring how children evaluate the healthfulness of packaged foods. *Can J Public Health* 103, e453-e458.

19. Chandon P (2013) How package design and packaged-based marketing claims lead to overeating. *Appl Econ Perspect Policy* 35, 7-31.

20. Lavriša Ž & Pravst I (2019) Marketing of foods to children through food packaging is almost exclusively linked to unhealthy foods. *Nutrients* 11, 1128.

21. Machado ML, Rodrigues VM, do Nascimento AB *et al.* (2019) Nutritional Composition of Brazilian Food Products Marketed to Children. *Nutrients* 11, 1214.

22. Rodrigues VM, Rayner M, Fernandes AC *et al.* (2016) Comparison of the nutritional content of products, with and without nutrient claims, targeted at children in Brazil. *Br J Nutr* 115, 2047-2056.

23. Arrúa A, Vidal L, Antúnez L *et al.* (2017) Influence of label design on children's perception of 2 snack foods. *J Nutr Educ and Behav* 49, 211-217. e211.

24. Roberto CA, Baik J, Harris JL *et al.* (2010) Influence of licensed characters on children's taste and snack preferences. *Pediatrics* 126, 88-93.

25. McGale LS, Halford JCG, Harrold JA *et al.* (2016) The influence of brand equity characters on children's food preferences and choices. *J Pediatr* 177, 33-38.

26. Hawkes C, Fox E, Downs SM *et al.* (2020) Child-centered food systems: Reorienting food systems towards healthy diets for children. *Glob Food Sec* 27, 100414.

27. WHO (World Health Organization) (2010) Set of recommendations on the marketing of foods and non-alcoholic beverages to children. http://apps.who.int/iris/bitstream/handle/10665/44416/9789241500210_eng.pdf?sequence=1 (accessed 24 June 2018).

28. WHO (World Health Organization) (2016) Report of the Commission on Ending Childhood Obesity. http://apps.who.int/iris/bitstream/handle/10665/204176/9789241510066_eng.pdf (accessed 12 October 2019).

29. Department of Health (South Africa) (2014) Foodstuffs, cosmetics and disinfectants act, 1972 (No.54 of 1972): Regulations relating to the labelling and advertising of foods: amendment. (Notice R.429). http://www.gpwonline.co.za/Gazettes/Gazettes/37695_29-5_Health.pdf (accessed 8 February 2019).

30. Wiles NL (2017) The nutritional quality of South African ready-to-eat breakfast cereals. *South Afr J Clin Nutr* 30, 8-16.

31. Mchiza ZJ, Temple NJ, Steyn NP *et al.* (2013) Content analysis of television food advertisements aimed at adults and children in South Africa. *Public Health Nutr* 16, 2213-2220.

32. Wicks M, Wright H, Wentzel-Viljoen E (2017) Restricting the marketing of foods and non-alcoholic beverages to children in South Africa: are all nutrient profiling models the same? *Br J Nutr* 116, 2150-2159.

33. Rayner M & Vandevijvere S (2017) INFORMAS Protocol: Food Labelling Module. https://auckland.figshare.com/articles/INFORMAS_Protocol_Food_Labelling_Module/5673643 (accessed 29 July 2019).

34. Deloitte Touche Tohmatsu Limited (2019) Global Powers of Retailing 2019. https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Consumer-Business/cons-global-powers-retailing-2019.pdf (accessed 14 September 2019).

35. Elliott C (2008) Assessing 'fun foods': nutritional content and analysis of supermarket foods targeted at children. *Obes Rev* 9, 368-377.

36. Mehta K, Phillips C, Ward P *et al.* (2012) Marketing foods to children through product packaging: prolific, unhealthy and misleading. *Public Health Nutr* 15, 1763-1770.

37. Giménez A, Saldamando Ld, Curutchet MR *et al.* (2017) Package design and nutritional profile of foods targeted at children in supermarkets in Montevideo, Uruguay. *Cad Saude Publica* 33, e00032116.

38. Chacon V, Letona P, Barnoya J (2013) Child-oriented marketing techniques in snack food packages in Guatemala. *BMC Public Health* 13, 967.

39. Elliott C (2019) Tracking kids' food: comparing the nutritional value and marketing appeals of child-targeted supermarket products over time. *Nutrients* 11, 1850.

40. Mediano Stoltze F, Reyes M, Smith TL *et al.* (2019) Prevalence of Child-Directed Marketing on Breakfast Cereal Packages before and after Chile's Food Marketing Law: A Pre- and Post-Quantitative Content Analysis. *Int J Environ Res Public Health* 16, 4501.

41. Devi A, Eyles H, Rayner M *et al.* (2014) Nutritional quality, labelling and promotion of breakfast cereals on the New Zealand market. *Appetite* 81, 253-260.

42. Department of Health (South Africa) (2017) Foodstuffs, cosmetics and disinfectants act, 1972 (No.54 of 1972): The regulations relating to the reduction of sodium in certain foodstuffs and related matters: amendment. (Notice R.1071). https://www.gov.za/sites/default/files/gcis_document/201710/41164gon1071.pdf (accessed 23 November 2021).

43. Ogle AD, Graham DJ, Lucas-Thompson RG *et al.* (2017) Influence of cartoon media characters on children's attention to and preference for food and beverage products. *J Acad Nutr Diet* 117, 265-270. e262.

44. Kraak VI & Story M (2015) Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs. *Obes Rev* 16, 107-126.

45. Abrams KM, Evans C, Duff BR (2015) Ignorance is bliss. How parents of preschool children make sense of front-of-package visuals and claims on food. *Appetite* 87, 20-29.

46. Dial LA & Musher-Eizenman DR (2020) Power of packaging: Evaluations of packaged fruits and vegetables by school-age children in the US. *Appetite* 148, 104591.

47. Corvalán C, Reyes M, Garmendia ML *et al.* (2019) Structural responses to the obesity and non-communicable diseases epidemic: Update on the Chilean law of food labelling and advertising. *Obes Rev* 20, 367-374.

48. Reyes M, Smith Taillie L, Popkin B *et al.* (2020) Changes in the amount of nutrient of packaged foods and beverages after the initial implementation of the Chilean Law of Food Labelling and Advertising: A nonexperimental prospective study. *PLoS Med* 17, e1003220.

49. Tatlow-Golden M & Garde A (2020) Digital food marketing to children: Exploitation, surveillance and rights violations. *Glob Food Sec* 27, 100423.

50. Frank T, Thow A-M, Ng SW *et al.* (2021) A Fit-for-Purpose Nutrient Profiling Model to Underpin Food and Nutrition Policies in South Africa. *Nutrients* 13, 2584.

CHAPTER 4 CONCLUSION AND RECOMMENDATIONS

4.1 Introduction

Childhood obesity in South Africa is increasing (Negash *et al.*, 2017:3; Shisana *et al.*, 2014:209) and research indicates that the food environment, especially food marketing, contribute significantly to children's diets (Sonntag *et al.*, 2015:8572). We set out to investigate children's exposure to food marketing in South African supermarkets. To our knowledge, this is the first study to investigate the packaging of *all* child-orientated foods sold in South African supermarkets.

The aim of this study was to investigate the extent and nature of child-orientated food marketing in South African supermarkets. More specifically, the objectives were to:

1) Identify packaged foods aimed at children in South African supermarkets;
2) Describe the various marketing techniques used by the identified packaged foods in South African supermarkets;
3) Classify the healthiness of the identified foods according to the published South African nutrient profiling model (SANPM) (Department of Health, 2014);
4) Compare the number of promotional characters, premium offers and claims on healthier versus unhealthy foods.

4.2 Main findings

4.2.1 Child-orientated foods in South African supermarkets

We found that most foods promoted to children are from food categories generally classified as unhealthy. A total of 477 foods were identified with confectionaries, such as chocolates and sweets, accounting for 33% of all included foods. Other food categories also extensively promoted to children are cereal and cereal products (16%), dairy (13%) and non-alcoholic beverages (11%). Little fruit and vegetables were marketed to children and mainly consisted of fresh apples (63.6%). Other studies from South Africa also reported that foods high in fat, sugar and/or salt (Wicks *et al.*, 2017:2153) and sweets and desserts (Mchiza *et al.*, 2013:4) were most frequently advertised to children on television. International studies also reported that food from categories like confectionaries, breakfast cereals and beverages were mostly promoted to children, with little foods from the fruit and vegetable category being promoted to children (Cairns *et al.*, 2013:212; Giménez *et al.*, 2017:4; Machado *et al.*, 2019:5).

4.2.2 Marketing techniques used on child-orientated foods in South African supermarkets

We investigated the use of three marketing techniques namely, promotional characters, premium offers and claims. These marketing techniques were widely used on the packaging of foods. Promotional characters were most frequently used and were present on 95% of all the included foods. Cartoon/company owned characters (59.3%) and 'for kids'/child-associated promotional characters (34.5%) were most often used. Examples of 'for kids'/child-associated promotional characters included images of children's hands on the packaging and illustration on the packaging indicating the food is 'the original play food' or that the food is for 'happy and healthy kids'. There was also a high frequency of claims present on foods (67.6%), knowing that parents view foods with claims as healthier and often use claims to evaluate the healthiness of their children's foods (Abrams *et al.*, 2015:25), the high prevalence of claims on foods can be viewed as a strategy to persuade parents to buy certain foods. Premium offers were used less often and were only present on 28.9% of all foods.

4.2.3 The healthiness of child-orientated foods

Overall, we found that most (61%) child-orientated foods were classified as unhealthy by the SANPM, this agrees with results of other studies (Elliott, 2019:5; Lavriša & Pravst, 2019:4; Wicks *et al.*, 2017:2154). Categories with the highest proportion of unhealthy foods include confectionaries, bread and bakery products, snack foods and sugar, honey and related products. In contrast to other studies (Devi *et al.*, 2014:256; Lavriša & Pravst, 2019:5), we found that most cereal and cereal products and non-alcoholic beverages were classified as healthy. The difference in results between the studies is likely due to the use of different nutrient profiling models to classify the healthiness of the foods. Additionally, 44.2% of all the dairy foods are classified as unhealthy by the SANPM. This is likely due to the large amount of flavoured milk beverages with a high sugar content and processed cheese with a high saturated fat and sodium content and a lower calcium content, included in this study.

4.2.4 The use of promotional characters, premium offers and claims on healthier versus unhealthy foods

All three marketing techniques were mostly present on unhealthy foods. Of particular concern, is the use of nutrient, health or health-related claims on predominantly unhealthy foods. Our study found 56.2% of foods containing a claim were classified as unhealthy by the SANPM. These findings support the need for food labelling and marketing regulations, such as Regulation 429

of the Foodstuffs, Cosmetics and Disinfectants Act (No. 54 of 1972) (Department of Health, 2014), to regulate the marketing of unhealthy foods to children.

In summary, we found evidence that most foods promoted to children in South African supermarkets, are unhealthy and marketing techniques, such as the use of promotional characters, are predominantly used to promote these unhealthy foods to children.

4.3 Strengths

Multiple retail outlets were used to collect data from, including one online store. The retail outlets also serve consumers of different socio-economic statuses, making the results applicable to children in urban areas irrespective of socio-economic status. The data was collected over an extended period of time which accounted for seasonal changes and newer foods. Additionally, all sides of the packaging were photographed and analysed to ensure that all the relevant data were captured. All these aspects ensured a good representation of the current nature and extent of food marketing used to target children in South African supermarkets. A second researcher checked 46.2% of all foods collected, to confirm that it met the pre-defined criteria of child-orientated marketing and enhance the quality of the data.

Furthermore, a validated nutrient profiling model was used in this study. The South African nutrient profiling model was found appropriate for the use of regulating the marketing of child-orientated foods in South Africa (Wicks *et al.*, 2017:2154). They also found that the model aligned very well with the food-based dietary guidelines of South Africa.

4.4 Limitations

This study has some limitations that should be considered when interpreting the results. Although this study gives a clear picture of the child-orientated food marketing children are exposed to in urban areas, it does not give a comprehensive overview of *all* the marketing techniques children are exposed to in South Africa. This is because firstly, data were only captured from urban supermarkets in Pretoria, Gauteng, effectively excluding supermarkets in other cities and provinces that might have different foods to offer. Foods from rural areas and foods from smaller stores and informal vendors were also excluded. Secondly, data was only collected from the packaging of foods and other marketing mediums, especially digital marketing mediums, such as social media, websites (except for the product pages from the online store) etc., were not investigated.

Limitations pertaining to data collection includes the fact that only one researcher collected data for the study. Ideally, two researchers should collect data independently and test for agreement

of results as described in another study (Mehta *et al.*, 2012:212). Only three marketing techniques were assessed, namely promotional characters, premium offers and claims. Including more marketing techniques in the future can assist to better understand the marketing strategies used to promote foods to children.

Furthermore, only one nutrient profiling model was used to classify the foods. Nutrient profiling models differ in characteristics, including the nutrients that are encouraged and the nutrients to limit (Wicks *et al.*, 2017:2152) and therefore, only using one model gives a limited interpretation of the healthiness of the foods.

4.5 Recommendations

4.5.1 It would be beneficial to evaluate the accuracy of the definition used in this study to identify child-orientated foods in South Africa. We defined child-orientated foods using definitions of similar studies (Elliott, 2008:262; Mehta *et al.*, 2012:1764), as a food of which the packaging contains *two or more* of the following:

- Pictures or cartoon images appealing to children;
- Specific or unusual shapes, colours, sizes or other iconography as well as the foregrounding or emphasis of any of these factors;
- Language, direct words or allusions referring to children, fun, play or school;
- Puzzles, games and premium offers, such as competitions, toys and giveaways, targeted at children.
- Cross-promotions or tie-ins with films, children's television programmes, celebrities, games, merchandise, websites and sports teams.

We found a few discrepancies during data collection regarding foods that subjectively seem child-orientated but does not meet the criteria of our study to be included. This mostly relates to the definition requiring *two or more aspects* to be present on the food to meet the criteria of being a child-orientated food. An example of a discrepancy is the use of a cartoon character on the label of a bottle of water. The food thus appeals to children, but it does not contain any other aspect of the definition (for example the presence of a claim) and does not therefore meet the criteria of containing *two or more aspects*. The definition of child-orientated foods should thus be modified to allow for the automatic inclusion of foods that are undeniably child-orientated despite only meeting *one aspect* of the criteria. Also, some parts of the definition allow a degree of subjectivity when interpreting it. For example, interpreting 'specific or unusual shapes' requires the researcher to use their own discretion to determine if a shape or colour is unusual.

Validating or standardization of the definition of child-orientated foods in South Africa can be useful for reliable, comparable future research.

4.5.2 Using more than one nutrient profiling model to classify the healthiness of foods can give more insight into the foods promoted to children. Internationally, various nutrient profiling models have been developed specifically for the purpose of restricting foods. As mentioned earlier, each nutrient profiling model encourages and limits specific nutrients, resulting in each model having different characteristics (Wicks *et al.*, 2017:2152). The SANPM has been found to be more lenient than other models. Using more than one nutrient profiling model would account for different strengths and limitations of the models and provide valuable insight into the healthiness of child-orientated foods. Recently, a different nutrient profiling model in South Africa has been suggested for restrictive regulations such as front-of-pack labelling and child-orientated marketing regulations (Frank *et al.*, 2021:8).

4.5.3 Similar to other studies (Lavriša & Pravst, 2019:4; Machado *et al.*, 2019:8), it would be advantageous in the future to investigate the inclusion of all non-child-orientated foods in supermarkets and that it can be compared to child-orientated foods in terms of healthiness and marketing techniques. This can improve our understanding of what foods are promoted to adults versus children and how the promotion of these foods differs. For example, Lavriša and Pravst (2019:5) found that 93% of foods with child-orientated marketing were classified as unhealthy by their nutrient profiling model, compared to 73% of non-child foods.

4.5.4 Since food marketing is becoming more digitalised, it will be beneficial to explore digital marketing mediums in South Africa such as social media and websites. The capabilities that brands have on digital platforms, such as building customer profiles and targeting specific consumers with specific advertisements, make this an extremely powerful marketing medium to use (Tatlow-Golden & Garde, 2020:2). Additionally, the WHO also identified digital marketing as a concerning marketing medium (WHO, 2016) and states that efforts to implement the World Health Organization's set of recommendations (WHO, 2010) need to include digital marketing to successfully reduce the exposure of children to the marketing of unhealthy foods.

4.5.5 Future studies also need to include retail outlets in rural areas. Since the nutrition transition is present in rural areas of South Africa (Wentzel-Viljoen *et al.*, 2018:2632), it is important for the foods available in these areas to be investigated. Retail outlets close to schools, and informal vendors, are especially of importance.

In conclusion, extensive use of marketing techniques on packaged foods in South African supermarkets are present and majority of these foods are classified as unhealthy by the SANPM. To curb the rise in childhood overweight and obesity in South Africa, it is necessary to ensure that the foods marketed to children are predominantly healthy. Therefore, regulations to restrict the marketing of unhealthy foods to children is crucial and implementing these regulations should be a high priority for South Africa.

BIBLIOGRAPHY

Abrams, K.M., Evans, C. & Duff, B.R. 2015. Ignorance is bliss. How parents of preschool children make sense of front-of-package visuals and claims on food. *Appetite*, 87:20-29. https://doi.org/10.1016/j.appet.2014.12.100

Cairns, G., Angus, K., Hastings, G. & Caraher, M. 2013. Systematic reviews of the evidence on the nature, extent and effects of food marketing to children. A retrospective summary. *Appetite*, 62:209-215. https://doi.org/10.1016/j.appet.2012.04.017

Department of Health (South Africa). 2014. *Foodstuffs, cosmetics and disinfectants act, 1972 (No.54 of 1972): Regulations relating to the labelling and advertising of foods: amendment. (Notice R.429).* http://www.gpwonline.co.za/Gazettes/Gazettes/37695_29-5_Health.pdf Date of access: 8 February 2019.

Devi, A., Eyles, H., Rayner, M., Mhurchu, C.N., Swinburn, B., Lonsdale-Cooper, E. & Vandevijvere, S. 2014. Nutritional quality, labelling and promotion of breakfast cereals on the New Zealand market. *Appetite*, 81:253-260. https://doi.org/10.1016/j.appet.2014.06.019

Elliott, C. 2008. Assessing 'fun foods': nutritional content and analysis of supermarket foods targeted at children. *Obesity Reviews*, 9(4):368-377. https://doi-org.nwulib.nwu.ac.za/10.1111/j.1467-789X.2007.00418.x

Elliott, C. 2019. Tracking kids' food: comparing the nutritional value and marketing appeals of child-targeted supermarket products over time. *Nutrients*, 11(8), 1850. https://doi.org/10.3390/nu11081850

Frank, T., Thow, A.-M., Ng, S.W., Ostrowski, J., Bopape, M. & Swart, E.C. 2021. A Fit-for-Purpose Nutrient Profiling Model to Underpin Food and Nutrition Policies in South Africa. *Nutrients*, 13(8):2584. https://doi.org/10.3390/nu13082584

Giménez, A., Saldamando, L.d., Curutchet, M.R. & Ares, G. 2017. Package design and nutritional profile of foods targeted at children in supermarkets in Montevideo, Uruguay. *Cadernos de Saude Publica*, 33(5), e00032116. https://doi.org/10.1590/0102-311X00032116

Lavriša, Ž. & Pravst, I. 2019. Marketing of foods to children through food packaging is almost exclusively linked to unhealthy foods. *Nutrients*, 11(5), 1128. https://doi.org/10.3390/nu11051128

Machado, M.L., Rodrigues, V.M., do Nascimento, A.B., Dean, M. & Fiates, G.M.R. 2019. Nutritional Composition of Brazilian Food Products Marketed to Children. *Nutrients*, 11(6):1214. https://doi.org/10.3390/nu11061214

Mchiza, Z.J., Temple, N.J., Steyn, N.P., Abrahams, Z. & Clayford, M. 2013. Content analysis of television food advertisements aimed at adults and children in South Africa. *Public Health Nutrition*, 16(12):2213-2220. https://doi.org/10.1017/S136898001300205X

Mehta, K., Phillips, C., Ward, P., Coveney, J., Handsley, E. & Carter, P. 2012. Marketing foods to children through product packaging: prolific, unhealthy and misleading. *Public Health Nutrition*, 15(9):1763-1770. https://doi.org/10.1017/S1368980012001231

Negash, S., Agyemang, C., Matsha, T.E., Peer, N., Erasmus, R.T. & Kengne, A.P. 2017. Differential prevalence and associations of overweight and obesity by gender and population group among school learners in South Africa: a cross-sectional study. *BMC Obesity*, 4(1), 29. https://doi.org/10.1186/s40608-017-0165-1

Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., ... SANHANES-1 Team. 2014. *The South African National Health and Nutrition Examination Survey, 2012: SANHANES-1*. Cape Town: HSRC Press.

Sonntag, D., Schneider, S., Mdege, N., Ali, S. & Schmidt, B. 2015. Beyond Food Promotion: A Systematic Review on the Influence of the Food Industry on Obesity-Related Dietary Behaviour among Children. *Nutrients*, 7(10):8565-8576. 5414. https://doi.org/10.3390/nu7105414

Tatlow-Golden, M. & Garde, A. 2020. Digital food marketing to children: Exploitation, surveillance and rights violations. *Global Food Security*, 27, 100423. https://doi.org/10.1016/j.gfs.2020.100423

Wentzel-Viljoen, E., Lee, S., Laubscher, R. & Vorster, H.H. 2018. Accelerated nutrition transition in the North West Province of South Africa: results from the Prospective Urban and Rural Epidemiology (PURE-NWP-SA) cohort study, 2005 to 2010. *Public Health Nutrition*, 21(14):2630-2641. https://doi.org/10.1017/S1368980018001118

WHO (World Health Organization). 2010. *Set of recommendations on the marketing of foods and non-alcoholic beverages to children*. http://apps.who.int/iris/bitstream/handle/10665/44416/9789241500210_eng.pdf?sequence=1 Date of access: 24 June 2018.

WHO (World Health Organization). 2016. *Tackling food marketing to children in a digital world: trans-disciplinary perspectives*. https://www.euro.who.int/__data/assets/pdf_file/0017/322226/Tackling-food-marketing-children-digital-world-trans-disciplinary-perspectives-en.pdf Date of access: 27 September 2021.

Wicks, M., Wright, H. & Wentzel-Viljoen, E. 2017. Restricting the marketing of foods and non-alcoholic beverages to children in South Africa: are all nutrient profiling models the same? *British Journal of Nutrition*, 116(12):2150-2159. https://doi.org/10.1017/S0007114516004244

ANNEXURES

ANNEXURE A: REQUEST FOR PERMISSION TO COLLECT DATA IN SUPERMARKETS

Private Bag X1290, Potchefstroom
South Africa 2520

Tel: 018 299-1111/2222
Fax: 018 299-4910
Web: http://www.nwu.ac.za

Centre of Excellence for Nutrition

Dear Manager,

Request for photographing products in the supermarket

I am a Registered Dietitian currently completing my MSc Dietetics degree at the North West University, Potchefstroom campus. We are doing a study to examine the marketing techniques that are used on the packaging of child-orientated products in South African supermarkets. The study is entitled: "The extent and nature of food marketing to children in South African supermarkets".

The purpose of this study is to understand what marketing techniques are being used and what types of products are directed at children. In South Africa, childhood obesity is a growing epidemic that affects the health status of many children. Children are more vulnerable to marketing because they are not yet able to recognise the real intent of marketing and therefore, we are specifically looking at child-orientated products.

We are only focussing on packaged foods and we are only interested in the packaging of the products. Photos will be taken of all the products that meet the study criteria. Using photos will help ensure that we do not miss any information and it helps to limit the amount of time that we have to spend in the supermarket to collect information. Information about the labelling will be retrieved from the photos and used in the study. Please note, we are not interested in the prices of products and no prices or display methods will be photographed, only the individual product packaging will be in the photo. Photos will be taken when the store is open and at a time that is suitable for everyone. There will only be one team member taking photos (Mrs M Gilfillan) and extra care will be taken to limit any inconvenience to the staff and customers of the supermarket.

We are requesting your permission to take photos in the supermarket that you manage. You do not have to give permission if you do not want to.

Thank you for considering our request.

Please do not hesitate to contact us if you have any questions.

Kind regards,

Marésa Gilfillan
MSc Dietetics Student

Cell phone: 072 222 3877
Email: maresaseyffert@gmail.com

I hereby give permission for Mrs M Gilfillan to take photos of child-orientated packaged food products in the supermarket. I have read the foregoing information and I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction.

Name of supermarket: _____

Name of Manager: _____

Signature of Manager: _____ **Date:** _____

ANNEXURE B: THE FOOD GROUP CLASSIFICATION SYSTEM OF THE GLOBAL FOOD MONITORING GROUP [1]

Table 2: Food group classification system of the Global Food Monitoring Group

Food group Code 1	Food group Code 2	Food group Code 3
1 Confectionery		
	1 Chewing gum	
	2 Chocolates and sweets*	
		1 Sugar-based
		2 Chocolate-based confectionery
		3 Sugar-free sweets
	3 Jelly	
	4 Cough lollies	
2 Convenience foods		
	1 Meal kits*	
	2 Other frozen foods**	
	3 Pizza*	
	4 Pre-prepared salads and sandwiches*	
	5 Ready meals*	
	6 Soup*	
3 Bread and bakery products		
	1 Biscuits*	
		1 Sweet unfilled biscuits
		2 Plain dry biscuits
		3 Savoury biscuits
		4 Sweet filled biscuits

[1] Rayner, M. & Vandevijvere, S. 2017. *INFORMAS Protocol: Food Labelling Module*. https://auckland.figshare.com/articles/INFORMAS_Protocol_Food_Labelling_Module/5673643 Date of access: 29 July 2019.

Food group Code 1	Food group Code 2	Food group Code 3
		5 Gluten-free sweet biscuits
	2 Bread*	
	3 Cakes, muffins and pastries*	
4 Cereal and cereal products		
	1 Breakfast cereals*	
	2 Cereal bars*	
	3 Couscous	
	4 Noodles	
	5 Pasta	
	6 Rice	
	7 Unprocessed cereal	
5 Dairy*		
	1 Ice cream and edible ices	
	2 Milk	
	3 Desserts	
	4 Cheese	
	5 Yoghurt and yoghurt drinks	
	6 Cream	
6 Edible oils and oil emulsions		
	1Cooking oil spray	
	2 Cooking oils*	
	3 Edible oils*	
	4 Coconut oil	
7 Eggs		
8 Fruit and vegetables		
	1 Fruits*	
	2 Herbs and spices	
	3 Jams and Marmalades	
	4 Nuts and seeds	
	5 Vegetables*	
9 Sauces and spreads		
	1 Sauces	
	2 Spreads	
	3 Mayonnaise and salad dressings	
10 Snack foods*		
	1 Crisps and snacks	
11 Fish and Seafood products		
12 Processed fish	1 Canned fish	
	2 Chilled fish	
	3 Chilled seafood	
	4 Frozen fish	
	5 Frozen seafood	
	6 Marinated mussels	
	7 Canned seafood	
	8 Other fish	

Food group Code 1	Food group Code 2	Food group Code 3
13 Special foods		
	1 Protein and diet bars	
	2 Baby foods	
	3 Diet soup mixes (meal replacements)	
	4 Breakfast beverages*	
	5 Diet drink mixes	
	6 Protein powders	
	7 Sports gels	
	8 Other fitness and diet products	
14 Meat and meat products		
Meat alternatives		
	1 Meat-free bacon	
	2 Meat-free products	
	3 Tofu	
Processed meat		
	1 Sliced meat (excluding salami and other cured meat)	
	2 Meat burgers*	
	3 Raw flavoured meats	
	4 Raw unflavoured meats	
	5 Bacon	
	6 Roast chicken	
	7 Frozen meat	
	8 Sausages and hotdogs*	
	9 Dried meat	
	10 Canned meat	
	11 Other meat products	
	12 Pate and meat spreads	
	13 Salami and cured meats	
	14 Whole hams and similar products	
15 Sugar, honey and related products		
	1 Condensed caramel	
	2 Dessert additions	
	3 Dessert toppings	
	4 Honey	
	5 Icing**	
	6 Other sugar-based products*	
	7 Sugar	
	8 Sweeteners	
	9 Syrup	
16 Non-alcoholic beverages (powdered and liquid)		
	1 Coffee and tea	
	2 Beverage mixes*	

Food group Code 1	Food group Code 2	Food group Code 3
	3 Cordials*	
	4 Electrolyte drinks*	
	5 Energy drinks*	
	6 Fruit and vegetable juices*	
	7 Soft drinks*	
	8 Waters *	
17 Unable to be categorised		
18 Vitamins and supplements		
19 Alcohol		

* Categories related to increasing or decreasing rates of obesity and diet-related NCDs (for selection as part of the minimal approach)

** Category only in the Nutritrack database (New Zealand food composition database for packaged foods) and not in the Global Food Monitoring Group database

ANNEXURE C: CODING FOR THE PROMOTIONAL CHARACTERS AND PREMIUM OFFERS [2]

Table 17: Coding for promotional characters and premium offers

Promotional Characters	Coding
Cartoon/company owned character e.g. M&Ms	1
Licenced character e.g. Dora the Explorer	2
Amateur sportsperson e.g. person playing a sport	3
Celebrity (non-sports) e.g. Jamie Oliver	4
Movie tie-in e.g. Shrek	5
Famous sportsperson/team e.g. All Blacks	6
Non-sports/historical events/festivals e.g. Christmas, Anzac Day	7
'For kids' e.g. image of a child, 'great for school lunches', 'for school lunchboxes'	8
Awards e.g. Best Food Award 2014, 'award winning', 'number one best-selling'	9
Sport events e.g. Rugby World Cup	10
None	0
Premium offers	
Game and app downloads	1
Contests	2
Pay 2 take 3 or other	3
20% extra or other	4
Limited edition	5
Social charity	6
Gift or collectable	7
Price discount	8
Loyalty programs	9
None	0

[2] Rayner, M. & Vandevijvere, S. 2017. *INFORMAS Protocol: Food Labelling Module*. https://auckland.figshare.com/articles/INFORMAS_Protocol_Food_Labelling_Module/5673643 Date of access: 29 July 2019.

ANNEXURE D: ETHICAL APPROVAL FROM THE NORTH-WEST UNIVERSITY ETHICS COMMITTEE

Private Bag X1290, Potchefstroom
South Africa 2520

Tel: 086 016 9698
Web: http://www.nwu.ac.za

North-West University Health Research Ethics Committee (NWU-HREC)

Tel: 018 299-1206
Email: Ethics-HRECApply@nwu.ac.za (for human studies)

15 November 2019

RESEARCH ETHICS COMMITTEE LETTER OF DECISION: NO RISK

Based on the review by the North-West University Health Research Ethics Committee (NWU-HREC) on 13/11/2019, the NWU-HREC hereby clears your study as a no risk study. This implies that the NWU-HREC grants its permission that, provided the general conditions specified below are met, the study may be initiated, using the ethics number below.

Study title: The extent and nature of food marketing to children in South African supermarkets
Principal Investigator/Study Supervisor/Researcher: Dr M Wicks
Student: M Gilfillan - 23444444

Ethics number:

N	W	U	-	0	0	9	7	2	-	1	9	-	A	1
Institution				Study Number						Year			Status	

Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation

Application Type: Single study
Commencement date: 15/11/2019

Risk: No Risk

General conditions:

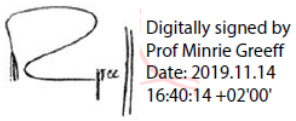
The following general terms and conditions will apply:

- *The commencement date indicates the first date that the study may be started.*
- *In the interest of ethical responsibility, the NWU-HREC reserves the right to:*
  - *request access to any information or data at any time during the course or after completion of the study;*
  - *to ask further questions, seek additional information, require further modification or monitor the conduct of your research;*
  - *withdraw or postpone clearance if:*
    - *any unethical principles or practices of the study are revealed or suspected;*
    - *it becomes apparent that any relevant information was withheld from the NWU-HREC or that information has been false or misrepresented;*
    - *submission of the required amendments, or reporting of adverse events or incidents was not done in a timely manner and accurately; and/or*
    - *new institutional rules, national legislation or international conventions deem it necessary.*
- *NWU-HREC can be contacted for further information via Ethics-HRECApply@nwu.ac.za or 018 299 1206*

The NWU-HREC would like to remain at your service and wishes you well with your study. Please do not hesitate to contact the NWU-HREC for any further enquiries or requests for assistance.

Yours sincerely,

NWU-HREC Chairperson



Head of the Faculty of Health Sciences Ethics Office for Research, Training and Support

Current details: (13210572) G:\My Drive\My Documents 20190227\NWU-HREC\NWU-HREC_Applications\NWU-HREC_Applications-2020\NWU-HREC_App01-20200213\NWU-00972-19-S1(M Wicks-M Gilfillan)-NR\NWU-00972-19-S1(M Wicks-M Gilfillan)-LoD\9.1.5.4.3_LOD_NWU-00972-19-A1_12-11-2019.docm
12 November 2019

File reference: 9.1.5.4.3

ANNEXURE E: PUBLIC HEALTH NUTRITION AUTHOR GUIDELINES

Cambridge Core

Home > Journals > Public Health Nutrition > Information > Instructions for authors

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Public Health Nutrition

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Instructions for authors

Scope | Article Types | Submission & Review Process | Publishing Ethics | Preprint Policy | Detailed Manuscript Preparation Instructions | Publication Agreement Form | Open Access | Green Open Access Policy | AuthorAID | Accepted Manuscripts | Proofs | Offprints | Information For Peer Reviewers | Contact

Public Health Nutrition (PHN) provides an international, peer-reviewed forum for the publication and dissemination of research with a specific focus on nutrition-related public health. The Journal publishes original and commissioned articles, high quality meta-analyses and reviews, commentaries and discussion papers for debate, as well as special issues. It also seeks to identify and publish special supplements on major topics of interest to readers.

We are delighted to let you know that that *PHN* will be a fully Open Access journal from January 2022 onwards, making it permanently and freely available to read, download and share around the world. This will mean that original papers submitted to the journal after 31st March 2021 are subject to payment of an article processing charge if accepted. You can find out more about this here. (https://www.cambridge.org/core/journals/public-health-nutrition/public-health-nutrition-open-access-frequently-asked-questions)

SCOPE

The scope of *Public Health Nutrition* includes multi-level determinants of dietary intake and patterns, anthropometry, food systems, and their effects on health-related outcomes. We welcome papers that:

- Address **monitoring and surveillance** of nutritional status and nutritional environments in communities or populations at risk
- Identify and analyse behavioral, sociocultural, economic, political, and environmental **determinants of nutrition-related public health**
- Develop **methodology** needed for assessment and monitoring
- Inform efforts to improve **communication of nutrition-related information**
- **Build workforce capacity** for effective public health nutrition action
- Evaluate or discuss the effectiveness of **food and nutrition policies**
- Describe the development, implementation, and evaluation of **innovative interventions and programs** to address nutrition-related problems
- Relate diet and nutrition to **sustainability** of the environment and food systems

Papers that do not fall within the scope as described above may be directed to more appropriate journals. We typically do not accept papers that describe only methodology/protocol unless the authors are able to make the case for novel methods that are of relevance to an international readership.

We prefer papers that are innovative (do not repeat research already undertaken elsewhere) and relevant to an international readership. Articles included as part of a special supplementary issue can be accepted even if descriptive or country-focused, if the contribution of the article to a supplement is clear and if the supplement, as a whole, fits the scope of the journal

ARTICLE TYPES

PHN publishes Research Articles, Short Communications, Review Articles, Commentaries, Letter to the Editors and Editorials. Manuscripts should be submitted via http://mc.manuscriptcentral.com/phnutr (http://mc.manuscriptcentral.com/phnutr). Please contact the Editorial Office on phn.edoffice@cambridge.org (mailto:phn.edoffice@cambridge.org) regarding any other types of submission.

A typical **Research Article** should be no more than 5000 words; not including the abstract, references, tables, figures and acknowledgements.

A **Short Communication** should consist of no more than 2000 words and have a maximum of 3 tables OR figures.

A **Commentary** is a short piece of less than 2000 words that provides perspective on a topic of current relevance or controversy.

A **Letter to the Editor** should discuss, criticise or develop themes put forward in papers published in PHN; they should not be used as a means of publishing new work. Acceptance will be at the discretion of the Editorial Board, and editorial changes may be required. Wherever possible, letters from responding authors will be included in the same issue.

References for all paper types (except for systematic reviews) should be limited to 50.

For systematic reviews and meta-analyses, the journal endorses the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement (see British Medical Journal (2009) 339, b2535). Such submissions should follow the PRISMA guidelines (http://prisma-statement.org/) and authors should include the PRISMA checklist with their submission (see instructions below).

We welcome submission of scoping reviews that use rigorous methodology to find relevant papers and to generate evidence for the need for further research in important areas of nutrition. In addition, such scoping reviews should provide a synthesis of the available literature. Authors should follow the guidance (http://www.prisma-statement.org/Extensions/ScopingReviews) provided by PRISMA for scoping reviews and include a completed checklist available from the PRISMA website.

In the case of research articles submitted as part of a special supplementary issue, every article should contribute to innovation, either independently or as part of the supplement. Articles submitted as part of a special supplement that are purely descriptive can only be publishable if:

1) the descriptive results reported are vital to meeting the aim(s) of the supplement, such as a comparative approach
2) the aim(s) of the supplement fits the scope of PHN as outlined under SCOPE
3) the text of the introduction, methods and discussion includes justification of the importance of the (descriptive) results in relation to the supplement aim(s)
4) the authors directly compare their descriptive results to other results from the supplement *or* in the submission letter the authors state that the comparison between their results and others will be made in another article in the same supplement and specify which one.

SUBMISSION AND REVIEW PROCESS

PHN uses ScholarOne Manuscripts (http://mc.manuscriptcentral.com/phnutr) for online submission and peer review.

As part of the online submission process, authors are asked to affirm that the submission represents original work that has not been published previously; that it is not currently being considered by another journal; and that each author has seen and approved the contents of the submitted manuscript.

Please note that PHN uses plagiarism-checking software to screen papers. By submitting your paper you are agreeing to any necessary originality checks your paper may undergo during the peer review process.

At submission, authors must nominate at least four potential referees who may be asked by the Editorial Board to help review the work. Where possible, authors should provide the email address and institution of their recommended referees. Please ensure that these potential referees are not located at the same affiliation as any of the co-authors. PHN uses a double-blind review process (https://www.cambridge.org/core/services/authors/information-for-peer-reviewers/how-to-peer-review-journal-articles), and manuscripts are normally reviewed by two external peer reviewers and a member of the Editorial Board.

Authors may submit a paper that has previously been posted on a preprint server, however please note that the journal operates a double-blind peer review process and therefore your paper may not be fully blinded as a result.

Revisions must be resubmitted within 2 months or they will be deemed a new paper. When substantial revisions are required after review, authors are normally given the opportunity to do this once only; the need for any further changes should reflect only minor issues

Appeals against an editorial decision will only be considered under exceptional circumstances. To have an appeal considered, please submit an appeal letter by responding to the decision letter directly, or directly to the Editorial Office at phn.edoffice@cambridge.org (mailto:phn.edoffice@cambridge.org). Decisions on appeals are made by the Editor-in-Chief. If over six months has passed between the original decision and a successful appeal, your paper may be subject to further peer review at the Editor's discretion.

If you have any other concerns about the handling of a manuscript or editorial processes of the journal, please contact phn.edoffice@cambridge.org (mailto:phn.edoffice@cambridge.org) or the journal's publisher, Cambridge University Press, on publishingethics@cambridge.org (mailto:publishingethics@cambridge.org).

Format-neutral submission

PHN has now introduced format-neutral submission for **original submissions only**. This means that authors do not need to format their article to journal style at this stage; and figures and tables can be kept in their original locations in the text. We do ask however that your article is line-numbered and is in an easily readable layout, which will aid our Editors and Reviewers in reviewing your paper. Please note that revised manuscripts will be subject to full formatting requirements of the journal, which can be found below.

ORCID

ORCID (https://orcid.org/about/what-is-orcid/mission) provides a unique identifier for researchers and through integration in key research workflows such as publication and grant applications, links your professional activities. We strongly encourage authors to link their ORCID identifier to their ScholarOne account. If you do not already have an ORCID identifier, registration is fast and free, and you can register directly from your ScholarOne account or at https://orcid.org/register (https://orcid.org/register). ORCID iDs provided in ScholarOne will be published in the final article.

PUBLISHING ETHICS

PHN adheres to the Committee on Publication Ethics (COPE) guidelines on research and publications ethics. The Journal considers all manuscripts on the strict condition that:

The manuscript is your own original work, and does not duplicate any previously published work;

The manuscript has been submitted only to the journal - it is not under consideration or peer review or accepted for publication or in press or published elsewhere;

All listed authors know of and agree to the manuscript being submitted to the journal; and

The manuscript contains nothing abusive, defamatory, fraudulent, illegal, libellous, or obscene.

Text taken directly or closely paraphrased from earlier published work that has not been acknowledged or referenced will be considered plagiarism. Submitted manuscripts in which such text is identified will be withdrawn from the editorial process. Any concerns raised about possible plagiarism or other violations of ethical guidelines in an article submitted to or published in PHN will be investigated fully and dealt with in accordance with the COPE guidelines.

The Nutrition Society, as the owner of PHN, endorses the Publication Ethics (https://www.cambridge.org/core/services/aop-file-manager/file/5b44807ace5b3fca0954531e/CUP-Research-Publishing-Ethics-Guidelines-2019.pdf) outlined by Cambridge University Press.

PHN recommends that authors consult the Reappraised Research Integrity Checklist (https://protect-eu.mimecast.com/s/fE8dCDqoqt33jq5fARYLh?domain=nature.com) by Grey et al. (*Nature* (2020)) before submitting their paper.

PREPRINT POLICY

A 'preprint' is an early version of an article prior to the version accepted for publication in a journal. We encourage authors to include details of preprint posting, including DOI or other persistent identifier, when submitting to PHN.

For full details, please see our preprint policy here (https://www.cambridge.org/core/services/open-access-policies/open-access-journals/preprint-policy).

DETAILED MANUSCRIPT PREPARATION INSTRUCTIONS

Language

Papers submitted for publication must be written in English and should be as concise as possible. We recommend that authors have their manuscript checked by an English language native speaker before submission, to ensure that submissions are judged at peer review exclusively on academic merit.

We list a (/core/services/authors/journals/preparing-and-submitting-your-paper)number of third-party services (https://www.cambridge.org/core/services/authors/language-services) specialising in language editing and / or translation, and suggest that authors contact as appropriate. Use of any of these services is voluntary, and at the author's own expense.

Spelling should generally be that of the *Concise Oxford Dictionary* (1995), 9th ed. Oxford: Clarendon Press. Authors are advised to consult a current issue in order to make themselves familiar with PHN as to typographical and other conventions, layout of tables etc.

Authorship

The Journal conforms to the International Committee of Medical Journal Editors (ICMJE) (http://www.icmje.org/) definition of authorship. Authorship credit should be based on:

Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; and
Drafting the article or revising it critically for important intellectual content; and
Final approval of the version to be published; and
Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

In the process of submitting an article to PHN, the corresponding author is prompted to provide further details about contributions to the article using the CRediT taxonomy (https://www.casrai.org/credit.html). People who have contributed to the article but do not meet the full criteria for authorship should be recognised in the acknowledgements section; their contribution can also be described in terms of the CRediT taxonomy.

Ethical standards

All submissions must abide by the guidelines in the World Medical Association (2000) Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects, with notes of clarification of 2002 and 2004 (https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/ (https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/)), the Guidelines on the Practice of Ethics Committees Involved in Medical Research Involving Human Subjects (3rd ed., 1996; London: The Royal College of Physicians) and the Guidelines for the Ethical Conduct of Medical Research Involving Children, revised in 2000 by the Royal College of Paediatrics and Child Health: Ethics Advisory Committee (Arch Dis Child (2000) 82, 177–182).

PRISMA Checklist

For systematic reviews and meta-analyses, PHN requires completion of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist (www.prisma-statement.org/ (http://www.prisma-statement.org/)). This policy includes all systematic reviews, including those for observational studies. A completed copy of the checklist should be submitted along with the manuscript, with page numbers noted as required. When a given item has not been addressed, authors must provide an explanation.

Editors and reviewers will not evaluate manuscripts based on the number of items checked off in the checklist. The purpose of the PRISMA guidelines is to recommend a critical set of items that should typically be reported in a manuscript. The guidelines are meant to improve transparency by helping authors improve the quality of their reporting. More clarity in reporting will facilitate review of your manuscript and increase its value to readers.

Vitamin D

The editorial by Sempos and Binkley (Public Health Nutr (2020) 23(7): 1153-1164 (https://www.cambridge.org/core/services/aop-cambridge-core/content/view/2858FFCB0EBDF95F1F496D7D09B03B42/S1368980019005251a.pdf/25hydroxyvitamin_d_assay_standardisation_and_vitamin_d_guidelines_paralysis.pdf)) in PHN's recent Special Issue on Vitamin D (https://www.cambridge.org/core/journals/public-health-nutrition/issue/themed-issue-vitamin-d/B2142132F8FF8DCC8018BE71CB167E03) explains clearly the need for standardization of vitamin D assays if we are to provide evidence to underpin updated vitamin D guidelines. This editorial also recommends that journals only publish manuscripts where vitamin D values have been retrospectively or prospectively standardized.

To ensure that Public Health Nutrition only publishes vitamin D studies that can contribute to the evidence base, it is required that future submissions standardize vitamin D measures. This requirement will not apply to submissions already in the system, and during the transition, authors will be given the opportunity to explain why it is not feasible for their study. Reviewers will be advised to assess any studies including vitamin D data for assay standardization. This will require that assays are fit for purpose, that is work in the population group being studied, and are either prospectively standardized for new work (J AOAC Int (2017) 100(5):1230-1233 (https://academic.oup.com/jaoac/article/100/5/1230/5654349), Br J Cl Pharm (2018) 84(10):2194-2207 (https://bpspubs.onlinelibrary.wiley.com/doi/full/10.1111/bcp.13652)), or retrospectively standardized for exiting data. Practical details of retrospective standardization can be found in Durazo-Arvizu et al (J AOAC Int (2017) 100: 1234-1243 (https://academic.oup.com/jaoac/article/100/5/1234/5654277)) and Sempos et al (Osteoporos Int (2017) 28:1503-1505 (https://link.springer.com/article/10.1007/s00198-017-3978-3)).

Use of the Dietary Inflammatory Index (DII®)

If you are using the DII in your paper, please make sure that you have followed the relevant instructions outlined here (https://www.cambridge.org/core/journals/public-health-nutrition/information/publishing-ethics).

Cover Letter

Authors are invited to submit a cover letter including a short explanation of how the article advances the field of public health nutrition in terms of research, practice, or policy, and of its relevance to an international readership. The text for the cover letter should be entered in the appropriate box as part of the online submission process.

Authors that are part of a funded supplement should make reference to this fact in the cover letter, identifying clearly which supplement their article is intended to be part of.

Title Page

Authors must submit a title page online **as a separate file to their manuscript**, to enable double-blind reviewing. For the same reason, the information on the title page should not be included in the manuscript itself. For a template title page, please click here (https://www.cambridge.org/core/journals/public-health-nutrition/information/template-title-page); the title page should include:

The title of the article;
Authors' names, given without titles or degrees;
Name and address of department(s) and institution(s) to which the work should be attributed for each author, with each author's institution(s) identified by a superscript number (e.g. A.B. Smith1);
Name, mailing address, and email address of the author responsible for correspondence about the manuscript;
A shortened version of the title, not exceeding 45 characters (including letters and spaces) in length;
Disclosure statements, as outlined below. These must be included on the title page and **not in the manuscript file**, to enable double-blind reviewing; if the paper is accepted, they will be inserted into the manuscript during production.

Acknowledgements

Here you may acknowledge individuals or organizations that provided advice and/or support (non-financial). Formal financial support and funding should be listed in the following section.

Financial Support

Please provide details of the sources of financial support for all authors, including grant numbers. For example, "This work was supported by the Medical research Council (grant number XXXXXXX)". Multiple grant numbers should be separated by a comma and space, and where research was funded by more than one agency the different agencies should be separated by a semi-colon, with "and" before the final funder. Grants held by different authors should be identified as belonging to individual authors by the authors' initials. For example, "This work was supported by the Wellcome Trust (A.B., grant numbers XXXX, YYYY), (C.D., grant number ZZZZ); the Natural Environment Research Council (E.F., grant number FFFF); and the National Institutes of Health (A.B., grant number GGGG), (E.F., grant number HHHH)".

This disclosure is particularly important in the case of research supported by industry, including not only direct financial support for the study but also support in kind such as provision of medications, equipment, kits or reagents without charge or at reduced cost and provision of services such as statistical analysis. **All such support**, financial and in kind, should be disclosed here.

Where no specific funding has been provided for research, please provide the following statement: "This research received no specific grant from any funding agency, commercial or not-for-profit sectors."

In addition to the source of financial support, please state whether the funder contributed to the study design, conduct of the study, analysis of samples or data, interpretation of findings or the preparation of the manuscript. If the funder made no such contribution, please provide the following statement: "[Funder's name] had no role in the design, analysis or writing of this article."

Conflict of Interest

The Journal adheres to the definition of conflicts of interest given by the (http://www.icmje.org/recommendations/browse/roles-and-responsibilities/author-responsibilities--conflicts-of-interest.html)ICMJE guidelines (http://www.icmje.org/recommendations/browse/roles-and-responsibilities/author-responsibilities--conflicts-of-interest.html). A conflict of interest exists when an author has interests that might inappropriately influence his or her judgement, even if that judgement is not influenced. Financial relationships such as employment, consultancies, or honoraria, are the most easily identifiable conflicts of interest. However, non-financial conflicts can also exist as a result of personal relationships, academic competition, and personal or intellectual beliefs.

Having a conflict of interest is not in itself wrong, and not all relationships may lead to an actual conflict of interest. However, PHN requires full disclosure about any relevant relationships, even if the author or reviewer does not believe it affects their judgment. These disclosures can then be used as a basis for editorial decisions. One question that provides some guidance in deciding which relationships merit declaration as potential conflicts of interest is this: if a relationship is not disclosed, would a reasonable reader feel misled? **When in doubt, full transparency is the best course of action**. Perceived conflicts of interest are as important as actual conflicts of interest, and undeclared conflicts (perceived as well as actual) can undermine the credibility of both the journal and the authors.

So that others can make judgements about potential conflicts, please provide details of **all known financial and non-financial (professional and personal) relationships with the potential to bias the work**. Where no known conflicts of interest exist, please include the following statement: "None."

Authorship

Please provide a very brief description of the contribution of each author to the research. Their roles in formulating the research question(s), designing the study, carrying it out, analysing the data and writing the article should be made plain.

Ethical Standards Disclosure

Manuscripts describing research involving human participants must include the following statement: "This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the [name of the ethics committee]. Written [or Verbal] informed consent was obtained from all subjects/patients." Where verbal consent was obtained, this must be followed by a statement such as: "Verbal consent was witnessed and formally recorded."

Manuscript Format

The requirements of PHN are in accordance with the Uniform Requirements for Manuscripts Submitted to Biomedical Journals produced by the ICMJE, and authors are encouraged to consult the latest guidelines (http://www.icmje.org/), which contain useful, general information about preparing scientific papers. Authors should also consult the CONSORT guidelines (http://www.consort-statement.org/) for reporting results of randomised trials.

For detailed instructions regarding **mathematical modelling**, **statistical analysis** and **nomenclature requirements**, please refer to the Appendix (/core/services/aop-file-manager/file/575eb76a284a79591a8a2912) to these instructions.

Continuous line and page numbering is required.

Typescripts should be prepared with 1.5 line spacing and wide margins (2 cm), the preferred font being Times New Roman size 12. At the ends of lines, words should not be hyphenated unless hyphens are to be printed (as per PHN's new policy on format-neutral submission for original submissions, please note that this applies to **revised papers only**).

MANUSCRIPTS SHOULD BE ORGANISED AS FOLLOWS:

Abstract

Each paper must open with a structured abstract of **not more than 250 words**. The abstract should consist of the following headings: Objective, Design, Setting, Participants, Results, Conclusions. All the headings should be used, and there should be a separate paragraph for each one. The abstract should be intelligible without reference to text or figures.

Graphical abstracts

A Graphical Abstract is a single image that summarises the main findings of a paper, allowing readers to gain quickly an overview and understanding of your work. Well-designed and prepared graphical abstracts are an important way to publicise your research, attracting readers, and helping to disseminate your work to a wider audience. Ideally, the graphical abstract should be created independently of the figures already in the paper but it could include a (simplified version of) an existing figure. Graphical abstracts are displayed at article level, and on the article landing page online. Submission of a graphical abstract is not mandatory but we welcome authors to submit one alongside their paper.

The graphical abstract should be submitted separately from the main paper using the 'Graphical Abstract' file designation on ScholarOne at revised submission stage. Graphical abstracts should be clear and easy for the viewer to read, and should illustrate one main point only. Permission to reuse images should be sought by the authors before submitting a graphical abstract.

We recommend that only TIFF, EPS or PDF formats are used for electronic artwork. Other non-preferred but usable formats are JPG, PPT and GIF files and images created in Microsoft Word. For further information about how to prepare your figures, including sizing and resolution requirements, please see our artwork guide. The image will be scaled to fit the appropriate space on Cambridge Core, so please ensure that any font used is clear to read, and that any text is included as part of the image file (although text should ideally be kept to a minimum). There is also no need to include the title 'Graphical Abstract' in your image.

Keywords

Authors should list at least four keywords or phrases (each containing up to three words).

Introduction

It is not necessary to introduce a paper with a full account of the relevant literature, but the introduction should indicate briefly the nature of the question asked and the reasons for asking it.

Methods

For manuscripts describing experiments involving human subjects, the required ethical standards disclosure statement must be included **on the title page only** as described above. It will then be inserted into this section of the manuscript during production.

Results

These should be given as concisely as possible, using figures or tables as appropriate. Data should not be duplicated in tables and figures.

Discussion

While it is generally desirable that the presentation of the results and the discussion of their significance should be presented separately, there may be occasions when combining these sections may be beneficial. Authors may also find that additional or alternative sections such as 'conclusions' may be useful.

References

As per PHN's new policy on format-neutral submission for original submissions, please note that the below applies to **revised papers only**.

References should be numbered consecutively in the order in which they first appear in the text using superscript Arabic numerals in parentheses, e.g. 'The conceptual difficulty of this approach has recently been highlighted[1,2]'. If a reference is cited more than once, the same number should be used each time. References cited only in tables and figure legends should be numbered in sequence from the last number used in the text and in the order of mention of the individual tables and figures in the text.

Names and initials of authors of unpublished work should be given in the text as 'unpublished results' and not included in the References. References that have been published online only but not yet in an issue should include the online publication date and the Digital Object Identifier (doi) reference, as per the example below.

At the end of the paper, on a page(s) separate from the text, references should be listed in numerical order using the Vancouver system. When an article has more than three authors only the names of the first three authors should be given followed by '*et al.*' The issue number should be omitted if there is continuous pagination throughout a volume. Titles of journals should appear in their abbreviated form using the NCBI LinkOut page (https://www.ncbi.nlm.nih.gov/projects/linkout/journals/jourlists.fcgi?typeid=1&type=journals&operation=Show). References to books and monographs should include the town of publication and the number of the edition to which reference is made. References to material available on websites should follow a similar style, with the full URL included at the end of the reference, as well as the date of the version cited and the date of access.

Examples of correct forms of references are given below.

Journal articles

Rebello SA, Koh H, Chen C *et al.* (2014) Amount, type, and sources of carbohydrates in relation to ischemic heart disease mortality in a Chinese population: a prospective cohort study. *Am J Clin Nutr* **100**, 53-64.

Villar J, Ismail LC, Victora CG *et al.* (2014) International standards for newborn weight, length, and head circumference by gestational age and sex: the Newborn Cross-Sectional Study of the INTERGROWTH-21st Project.*Lancet* **384**, 857-868.

Alonso VR & Guarner F (2013) Linking the gut microbiota to human health. *Br J Nutr* **109**, Suppl. 2, S21–S26.

Bauserman M, Lokangaka A, Gado J et al. A cluster-randomized trial determining the efficacy of caterpillar cereal as a locally available and sustainable complementary food to prevent stunting and anaemia. *Public Health Nutr*. Published online: 29 January 2015. doi: 10.1017/S1368980014003334.

Books and monographs

Bradbury J (2002) Dietary intervention in edentulous patients. PhD Thesis, University of Newcastle.

Ailhaud G & Hauner H (2004) Development of white adipose tissue. In *Handbook of Obesity. Etiology and Pathophysiology*, 2nd ed., pp. 481–514 [GA Bray and C Bouchard, editors]. New York: Marcel Dekker.

Bruinsma J (editor) (2003) *World Agriculture towards 2015/2030: An FAO Perspective*. London: Earthscan Publications.
World Health Organization (2003) *Diet, Nutrition and the Prevention of Chronic Diseases*. Joint WHO/FAO Expert Consultation. WHO Technical Report Series no. 916. Geneva: WHO.

Keiding L (1997) *Astma, Allergi og Anden Overfølsomhed i Danmark – Og Udviklingen 1987–199I (Asthma, Allergy and Other Hypersensitivities in Denmark, 1987–1991)*. Copenhagen, Denmark: Dansk Institut for Klinisk Epidemiologi.

Sources from the internet

Nationmaster (2005) HIV AIDS – Adult prevalence rate. http://www.nationmaster.com/country-info/stats/Health/HIV-AIDS/Adult-prevalence-rate (accessed June 2013).

For authors that use Endnote, you can find the style guide for PHN here (https://endnote.com/style_download/public-health-nutrition/).

Tables

Tables should be placed in the main manuscript file at the end of the document, not within the main text. Be sure that each table is cited in the text. Tables should carry headings describing their content and should be comprehensible without reference to the text.

The dimensions of the values, e.g. mg/kg, should be given at the top of each column. Separate columns should be used for measures of variance (SD, SE etc.), the ± sign should not be used. The number of decimal places used should be standardized; for whole numbers 1.0, 2.0 etc. should be used. Shortened forms of the words weight (wt) and height (ht) may be used to save space in tables.

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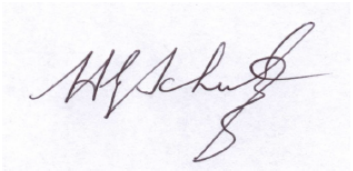
This document certifies that the above manuscript was proofread and edited by Hilderich George Schultz from SCHULTZ TAALDIENSTE / LANGUAGE SERVICES.

The manuscript was edited for proper SA English (Chapter 3: UK English) language, grammar, punctuation, spelling, numbering, formatting and overall style by myself. The editor endeavoured to ensure that the author's intended meaning was not altered during the review. All amendments were tracked with the Microsoft Word™ "Track Changes" feature. Therefore, the author had the option to reject or accept each change individually.



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