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Investigating the nutrient content of food prepared in popular children's TV cooking shows

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Abstract

Purpose: Analyse the nutritional content of recipes prepared in popular children's TV cooking shows.

Design: A cross-sectional analysis of 150 recipes focusing on calorie, total fat and carbohydrates, saturated fatty acids, fibre, sugar, protein and salt content. Main course recipes were evaluated against the United Kingdom (UK) Food Standards Agency (FSA), and the proportions of energy derived from each nutrient were evaluated against the World Health Organization (WHO) recommendations.

Findings: While a significant proportion met the FSA and WHO recommendations for energy and salt, 58% were above the FSA recommendation for total fat ($\chi^2 = 5.598, p = .01$), 56% failed to meet the recommendations for saturated fatty acids ($\chi^2 = 4.551, p = .03$), and 60% exceeded the FSA protein recommendations ($\chi^2 = 12.602, p < .001$). Only 17% and 21% of the recipes met the minimum recommendations for carbohydrates ($\chi^2 = 30.429, p < .001$) and fibre ($\chi^2 = 16.909, p < .001$), respectively. Only 37% had adequate portion of fruits and vegetables. The nutritional content varied depending on the composition of the recipes; vegetarian recipes were more likely to meet the recommendations than poultry, meat or fish recipes.

Implications: Foods displayed by children's popular TV cooking shows fall short of the standards for healthy eating, thus warranting further research on how these shows affect eating behaviour.

Originality: This study is the first to consider children's TV cooking shows as a platform of exposure to unhealthy foods.

Key words: Nutritional Content, Analysis, TV cooking shows, Children

Introduction

23

24 The global burden of obesity has increased to epidemic proportions over the past three
25 decades (Finucane *et al.*, 2011; Han *et al.*, 2010; Stewart, 2011). The prevalence of childhood
26 obesity has followed this upward trend, with the 2013 global burden of disease study showing a
27 47.1% increase in childhood obesity between 1980 and 2013 (Ng *et al.*, 2014). Another
28 prevalence estimation of the global burden of childhood obesity showed an increase from 5.2%
29 in 1990 to 7.7% in 2010 and projected a further increase to 10.9% by 2020 (De Onis *et al.*,
30 2010). The most recent WHO estimations show that more than 340 million children between
31 five and 19 were overweight or obese in 2016 (WHO, 2018). The rise in prevalence of childhood
32 obesity and weight gain is positively associated with a high prevalence of non-communicable
33 diseases such as strokes, coronary heart diseases, hyperlipidaemia, diabetes and cancers in
34 adulthood (The Lancet, 2015; Ebbeling *et al.*, 2002). The consequences of obesity therefore
35 warrant prevention and early treatment of childhood obesity. In children, modifying television
36 (TV) consumption and promoting the consumption of healthier foods have been listed as
37 potentially effective preventive actions to tackle obesity early on (Lobstein *et al.*, 2004). This
38 study therefore investigates the role of children's TV cooking shows in exposing children to
39 unhealthy food messages.

40 The association between childhood obesity and TV watching is well researched and has
41 been mainly attributed to food advertising (Bodenlos and Wormuth, 2013; Boyland and Halford,
42 2013; Dietz and Gortmaker, 1985). Studies that analysed the nutrient content of foods advertised
43 during children's TV shows showed that advertised foods were high in fat, sugars and salt, and
44 were consistent with dietary patterns associated with childhood obesity (Byrd-Bredbenner and

45 Grasso, 2000; Harrison and Marske, 2005). Exposure to food advertisements has been linked not
46 only to an increase in consumption of unhealthy foods shown in these advertisements, but also
47 with increased intake of fast foods and take-away foods (French *et al.*, 2001) and a decrease in
48 the consumption of fruits and vegetables (Boynton-Jarrett *et al.*, 2003). Food cue reactivity and
49 mere repetitive exposure theories have explained how exposure to food cues on TV can induce
50 cravings (Boswell and Kober, 2016; Jansen, 1998) and alter food preferences among audiences
51 (Zajonc, 2001). Therefore, if TV advertisements advertise mainly unhealthy foods, audiences
52 who are exposed to these advertisements might crave and consume more of these foods. In
53 response to the accumulating evidence on the effect of exposure to unhealthy foods through TV
54 advertisements (Cairns *et al.*, 2013), the European Union (EU) instituted a pledge regulating
55 food and beverage advertising to children under the age of 12 (EU, 2015). Nevertheless, a recent
56 study has shown that European children are still exposed to unhealthy foods via online
57 advertising (Neyens and Smits, 2016) and perhaps even TV cooking shows.

58 Children watch TV cooking shows such as Junior MasterChef, for entertainment, vicarious
59 participation and education (Goodchild, 2012). According to Goodchild (2012), parents reported
60 that watching Junior MasterChef sparked an interest in cooking. In another study that assessed
61 what children aged 8-9 associated with food, a sizable number of children named celebrity chefs
62 (Caraher *et al.*, 2004). Some studies have suggested that through watching TV cooking shows
63 such as Junior MasterChef, children can gain culinary capital and learn the use of food language
64 and cooking practices (Schmeh, 2014). However, this optimistic view might not always match
65 the reality. Although little is known about the effects of TV cooking shows on children, a recent
66 study found that children who watched a TV cooking show involving pancakes and sugar

67 consumed more pancakes and sugar after watching the TV cooking show compared with those
68 who watched a non-food related TV show (Neyens and Smits, 2017). This finding is in line with
69 other studies about TV cooking shows and adult audiences. Among adult women, watching a TV
70 show containing food in an experimental setting was proven to result in a higher consumption of
71 sweets compared to watching a non-food related TV show (Bodenlos and Wormuth, 2013). A
72 similar association between watching TV cooking shows and consuming sweets among women
73 was found in a survey study (De Backer and Hudders, 2016), which also revealed that for both
74 adult men and women, watching TV cooking shows was unrelated to the intake of fruits and
75 vegetables (De Backer and Hudders, 2016). Furthermore, women that watch TV cooking shows
76 and frequently cook from scratch were more likely to report higher BMIs compared to those that
77 watch but do not cook (Pope *et al.*, 2015). These results combined with the aforementioned food
78 cue reactivity (Boswell and Kober, 2016; Jansen, 1998) and mere repetitive exposure theories
79 (Zajonc, 2001) indicate that the foods prepared in TV cooking shows may not reflect healthy
80 food choices.

81 Several studies that have examined adult TV cooking shows indicate that recipes from
82 these warrant public health concern (e.g. Jones *et al.*, 2012; Howard *et al.*, 2012). A nutrient
83 content analysis study that compared UK TV chefs' recipes to supermarket ready meals found
84 that TV chefs' recipes were not only less healthy but they also failed to meet the World Health
85 Organization (WHO) guidelines for healthy eating (Howard *et al.*, 2012). Another study showed
86 that UK celebrity chefs' recipes were high in total fat, saturated fatty acids and salt (Jones *et al.*,
87 2012), and another nutrient content analysis of two United States (US) based Food Network
88 shows found that the recipes on these shows were high in calories, sodium and saturated fatty

89 acids and could therefore be considered unhealthy (Silva *et al.*, 2010). The standards used to
90 evaluate the nutritional content of recipes on adult TV shows varied among these
91 aforementioned studies; however, they all found the recipes to fall short of respective standards.
92 The question of whether recipes from TV cooking shows targeting children follow similar trends
93 remains unanswered. Based on a keyword search of Google scholar and Ebscohost research
94 databases, this study is the first to analyse the nutritional content of TV cooking shows that
95 target children. Considering the paucity of studies in this area, this study seeks to determine
96 how the nutritional content of recipes prepared on children's TV cooking measure up against the
97 standards of healthful eating. This study thus aims to (1) analyse the nutritional messages that
98 children are exposed to through TV cooking shows and (2) inform whether the current situation
99 is a public health concern.

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Methods

102 *Selection of Shows and Recipes*

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(Table 1)

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A cross-sectional analysis of 150 recipes from popular children's TV cooking shows was performed. The TV cooking shows were chosen according to their popularity and availability; however, the majority of recipes (117 = 78%) came from the most popular children's TV cooking show Junior MasterChef. Junior MasterChef was selected because it is the longest running children's TV cooking show that was first broadcast in the UK in 1994, and it has been adapted and broadcast in more than 20 countries including Australia, Belgium, the United States and France. Recipes from other children's TV cooking shows such as the US based Kid's Cook-Off with Rachel Ray and the UK based Matilda and the Ramsay Bunch and Disney's First Class Chefs were included in the analysis because they aired recently and were the most popular TV cooking shows of 2016. Table 1 presents the details of all the TV cooking shows analysed in this study. The nutrient content of the recipes was not compared by country because the number of recipes was too restricted for a country-specific analysis.

Main course and dessert recipes were selected for analysis. Recipes for entrees that are parts of a main course and snacks such as "*how to make fresh pasta*" or "*how to make mayonnaise*" were excluded from the analysis. Similar to Schneider *et al.*'s (2013) nutrient content analysis performed on food blogs, the recipes in this study were categorised by protein source, i.e. vegetarian, seafood, red meat, poultry and desserts. This categorisation also enabled contrasting of vegetarian and non-vegetarian recipes. Dessert recipes were included in this

122 study because of the significant interest in sweet foods among children (Ventura and Mennella,
123 2011) and the overrepresentation of dessert recipes in children’s TV cooking shows. The
124 proportions of recipes that met each nutrient recommendation (Benelam and Stanner, 2015)
125 were calculated for all the main course recipes and in each recipe category to determine which
126 category had the highest number of recipes that met the recommendation for each nutrient.

127

128 *Nutritional Content of the Recipes*

129 The analyses were performed using the Nubel meal planning software version 6.6 ^[1], and
130 all analyses were carried out according to the portion specified by number of servings on all
131 recipes, e.g. “this recipe serves four”. The nutritional content analysis was based on information
132 provided by the recipes and did not take into account any potential additions or changes made
133 by the consumer. The content of energy (kcal), total fat (g), saturated fatty acids (g), total
134 carbohydrates (g), sugar (sum of mono- and disaccharides, both natural and added) (g), fibre
135 (g), protein (g) and salt (g) was calculated for all the recipes. Raw ingredients were used for all
136 analysis. If the nutrient content of a food item was unavailable in the Belgian food composition
137 database, the US Department of Agriculture (USDA, 2015) food composition database (version
138 3.8.6.4 10.02.2017) was used, and data were manually added. For standardisation purposes, all
139 fluids such as milk, oil and butter that were in millilitres, centilitres or decilitres were converted
140 to grams using an appropriate product density for each item. For all recipes that contained
141 cooking fats and salt in the ingredients but no specific amounts, standard amounts of 15 g
142 (spoon) and 6 g (teaspoon) were added for cooking fats and salt, respectively. A pinch of salt was
143 converted to .4 g based on the online search computational engine Wolfram Alpha^[2] To evaluate

144 the main course recipes' compliance with nutrient guidelines for the contribution of specific
145 food groups such as fruits and vegetables, this analysis also considered starch and protein
146 sources. Information on the number of main course recipes that were based on starchy foods,
147 protein sources for each recipe and the fruits and vegetables content per recipe (in grams) was
148 analysed for each recipe.

149

150 *Comparisons*

151 The recipes were evaluated against two guidelines. Firstly, the nutrient composition of the
152 main course recipes was evaluated against a criteria developed by Benelam and Stanner (2015)
153 based on the UK FSA guidelines. Dessert recipes were excluded from the comparisons against
154 the FSA guidelines because they do not constitute a main course. Benelam and Stanner's (2015)
155 criteria assume that each nutrient of a main meal (lunch or dinner) is approximately 30% of an
156 adult's daily nutrient intake. This percentage was used to estimate the appropriate energy intake
157 for children (Benelam and Stanner, 2015). The TV cooking shows used in this study target
158 audiences aged mainly between 8 and 16; thus, the mean energy recommendations from the
159 Food and Agricultural Organization (FAO, 2001) for this age range were used to establish energy
160 criteria for the main course recipes. The approximated mean energy requirement for moderately
161 active boys and girls based on the FAO (2001) recommendations is 2,230 kcal. The FAO
162 recommendation was used to establish an approximate daily energy requirement, because the
163 energy intake recommendations for children vary according to age and physical activity.
164 Assuming that each recipe accounts for 30% of the required daily energy intake, 669 kcal was
165 the maximum requirement per main course recipe. This estimation was in line with the energy

166 recommendations used in other nutritional content studies: Benelam and Stanner (2015) used
167 600 kcal and Schneider *et al.* (2013) used 670 kcal. Table 2 displays the nutrient criteria used to
168 evaluate the main course recipes. In addition, the UK FSA traffic light system was used to visually
169 present the key nutrients in the main course recipes from this study. Each macronutrient in each
170 main course recipe was assigned a traffic light colour based on the median nutrient content per
171 recipe: red indicated high, amber indicated medium and green indicated low, depending on the
172 content as stated in the FSA guidelines (FSA, 2013).

173 Secondly, all recipes (main course and desserts) were evaluated – based on proportions
174 of energy derived from each nutrient – against the WHO recommendations for the prevention of
175 diet-related chronic diseases published in 2003. As the WHO guidelines are based on nutrient
176 intake per day not per meal, dessert recipes were included. Although several recipes in our
177 sample come from UK-based TV cooking shows, recipes from other countries whose
178 recommendations may differ from the UK FSA were also selected. Thus, the WHO
179 recommendations were also used to allow evaluation of the recipes against a more international
180 standard.

181 Each nutrient was converted from grams to kilocalories, and the proportions of energy
182 derived from of each nutrient were calculated and compared to the WHO recommendations. For
183 nutrients that differ for adults and children, such as saturated fatty acids, the children's
184 recommendation was used as a standard (WHO, 2010). As the proportions of energy derived
185 from each nutrient did not apply to salt and energy, these were not included in the WHO
186 analysis.

187

188

(Table 2)

189

190 *Statistical Analysis*

191 Data were analysed using IBM's Statistical Package for the Social Sciences (SPSS version
192 24). Non-parametric tests were performed because none of the analysed nutrient data was
193 normally distributed. Chi Square tests were conducted to compare the content of each nutrient
194 and the representation of the food groups per portion to the recommendations. A Kruskal-Wallis
195 test was used to compare the recipe categories. The threshold for significance was .05 and was
196 adjusted using the Bonferroni correction for multiple tests.

197

198 *Ethical Considerations*

199 As human participants were not involved in this analysis, no specific ethical approval was
200 required.

201

202

Results

203 *The Sample*

204 The number of recipes analysed was $N = 150$, comprising $n = 39$ dessert recipes and $n =$
205 111 main course recipes. Table 1 presents the representation of the different TV cooking shows.
206 Of the 111 main course recipes, $n = 21$ were categorised as vegetarian and included all meat free
207 dishes (pasta, pizza, salads), $n = 36$ featured seafood as the main protein source, and $n = 31$ and n
208 = 23 featured red meat and poultry as protein sources, respectively.

209

210 *Comparison of the Main Course Recipes Against FSA Guidelines*

211 *Energy*

212 Based on the mean energy requirements for the target age group of these TV cooking
213 shows, the main course recipes did not deviate significantly from the energy recommendation of
214 669 kcal per recipe, $\chi^2 = 2.546$, $p > .05$; 62% of the recipes met this recommendation. No
215 significant difference in energy was found between the different categories of recipes, $\chi^2 =$
216 5.996, $p = .12$ (see Table 3).

217

218 *Fat*

219 A significant proportion (58%) of the main course recipes contained higher amounts of
220 total fat than the recommended 21 g per meal, $\chi^2 = 5.598$, $p = .01$. No statistically significant
221 differences in total fat content among the recipe categories were found, $\chi^2 = 4.612$, $p = .20$. At
222 least 56% of the recipes exceeded the saturated fatty acids recommendations, $\chi^2 = 4.551$, $p = .03$.
223 The categorical comparison of the recipes revealed no statistically significant differences
224 between the recipe categories, $\chi^2 = 5.31$, $p = .14$ (see Table 3). The main course recipes were
225 high in total fat and saturated fatty acids regardless of recipe category.

226

227 *Carbohydrates*

228 A statistically significant proportion of the main course recipes (83%) had lower
229 carbohydrate content than the minimum recommendation of 75 g, $\chi^2 = 30.429$, $p < .001$. The
230 recipe categories did not significantly differ in carbohydrate content, $\chi^2 = 1.75$, $p = .78$. The sugar
231 content of the main course recipes was within the recommendations, $\chi^2 = .285$, $p = .6$, and no

232 statistically significant differences were evident among the recipe categories, $\chi^2 = .955$, $p = .8$.
233 The fibre content in most of the main course recipes (79%) was significantly lower than the FSA
234 recommendations of 7.2 g and a significant proportion of the recipes fell short of this
235 recommendation, $\chi^2 = 16.909$, $p < .001$. No statistically significant difference was found in the
236 proportion of recipes that met the recommendations for fibre content between recipe
237 categories, $\chi^2 = 7.121$, $p = .06$ (see Table 3).

238

239 *Protein*

240 Protein content was higher than the recommended 17 g in 60% of the main course
241 recipes, $\chi^2 = 12.602$, $p < .001$, and varied significantly between recipe categories, $\chi^2 = 36.58$, p
242 $< .01$. The vegetarian recipes had the lowest protein content compared to other recipe categories
243 (see Table 3).

244

245 *Salt*

246 The median salt content of the main course recipes was 1.3 g (0.5 - 2) per recipe and did
247 not deviate significantly from the recommended maximum of 1.8 g, $\chi^2 = 3.842$, $p = .05$. A
248 comparison of the salt content among recipe categories showed a significant variation, with the
249 vegetarian recipes containing the least salt, $\chi^2 = 34.29$, $p < .01$ (see Table 3).

250

251 *Food groups*

252 Only 37% of the main course recipes had adequate portions of fruits and vegetables. The
253 recipes therefore fell short of the recommendations, $\chi^2 = 9.206$, $p = .02$. The amount of fruit and

254 vegetables of the recipes varied significantly among the different recipe categories; $\chi^2 = 12.030$,
255 $p = .01$. The seafood and red meat recipes had lower fruit and vegetable content than did the
256 vegetarian recipes (see Table 3).

257 All the main course recipes met the minimum recommendation of having a portion of
258 protein from either a non-dairy or dairy source. Although the recipes met the minimum
259 standard for protein portions, $\chi^2 = 1.292$, $p > .05$, 45% of the recipes had dual sources of protein,
260 i.e. they used both dairy and non-dairy protein.

261 (Table 3)

262

263 *Traffic Light Colour Presentation of the Key Macronutrients in Main Course Recipes*

264 The modal traffic light colour was red for total fat and saturated fatty acids and amber for
265 salt and sugar (see Figure 1). The main course recipes were high in total fat and saturated fatty
266 acids and contained moderate amounts of salt and sugar. Except the vegetarian recipes, the rest
267 of the main course recipes categories were recognised by high total fat and saturated fatty acids
268 and medium salt and sugar. Red meat recipes were also high in salt. None of the nutrients were
269 in the green.

270

271 (Figure 1)

272

273 *Comparison of all Recipes (Including Dessert Recipes) Against the WHO Guidelines*

274 The nutrient content of the recipes followed similar trends to the comparisons against
275 the FSA guidelines, i.e. the proportion of energy derived from total fat, saturated fatty acids and

276 protein was higher than the recommendations. The recipes (including desserts) were also low in
277 carbohydrates and fibre (see Table 4), and when the dessert recipes were included, sugar $\chi^2 =$
278 143.69, $p < .01$, was higher than the recommendations. Also similar to the FSA comparison, the
279 median nutrient content of the vegetarian recipes came closest to meeting the recommendations
280 and had the biggest proportion of the recipes that met the WHO recommendations for protein.

281

Discussion

282 The recipes prepared in the children’s TV cooking shows that were analysed in this study
283 were higher in total fat, saturated fatty acids and protein and lower in total carbohydrates and
284 fibre than both the FSA and WHO recommendations. While the recipes were within the
285 recommendations for salt and energy, the findings for sugar varied depending on whether
286 desserts were included. The inclusion of the dessert recipes altered the sugar content, making it
287 higher than the WHO recommendations but did not alter how the other nutrients measured up
288 against the recommendations. In sum, the nutrient content of the recipes fell short of the
289 recommendations made by the FSA and the WHO.

290 Similar to recipes presented on adult TV cooking shows, the recipes from the children’s
291 TV cooking shows were high in total fat and saturated fatty acids (Silva *et al.*, 2010). However,
292 the recipes in this current analysis scored better for sodium and sugars compared to adult
293 cooking show recipes, which were found to have high sodium and sugar contents (Silva *et al.*,
294 2010; Jones *et al.*, 2012). Notably, previous studies used different methods to evaluate the
295 recipes from the current analysis; the UK study (Jones *et al.*, 2012) used the British healthy
296 eating index while the US study (Silva *et al.*, 2010) compared the recipes against US
297 recommendations. When comparing the findings of this study to a nutrient content of recipes by
298 British celebrity chefs (Howard *et al.*, 2012) that used similar standards, more congruencies
299 were evident. The recipes of the British celebrity chefs and the children’s TV cooking shows
300 were both high in total fat, saturated fatty acids and protein and were within the
301 recommendations for sodium. Similar findings were obtained for sugar prior to the inclusion of
302 dessert recipes. The visual presentation of the main course recipes from children’s TV cooking

303 shows using the UK traffic light system also depicted similar traffic light colours to the UK TV
304 chefs' recipes, i.e. the recipes had a red light for saturated fatty acids and total fat (Howard *et al.*,
305 2012). While the TV chefs' recipes were low in sugars and salt (Howard *et al.*, 2012), the
306 children's TV cooking shows analysed herein contained medium levels of salt and sugar.

307 The recipes failed to meet the minimum recommendations for fruits and vegetable
308 portions, which is concerning considering that increasing consumption of fruits and vegetables
309 is one of the key strategies for preventing diet related non-communicable diseases (The Lancet,
310 2010; He *et al.*, 2006). None of the previous nutrient content analysis conducted on TV cooking
311 shows considered the representation of the different food groups in the recipes. Although the
312 recipes adequately met the standards for protein sources, a majority of the recipes added more
313 than one source of protein, e.g. fish or meat, with cream and cheese in one recipe, which may
314 have contributed to the excessive protein content of the recipes. Large portions of meat and fish
315 might also have contributed to the excessive protein content. The opposite is true for
316 carbohydrates; although the recipes met the minimum recommendations of having at least one
317 starchy food per recipe, the carbohydrate content still fell short of the recommendations. The
318 presentation of these key food groups is important in a nutritional content analysis because they
319 can indicate the possible causes of the shortcomings and contribute to devising perhaps simpler
320 ways of improving the recipes.

321 The vegetarian recipes scored better than other recipe categories against the FSA and
322 WHO recommendations, which is consistent with a previous study that analysed the nutrient of
323 food blogs (Schneider *et al.*, 2013). However, comparatively few vegetarian recipes were
324 presented on children's TV cooking shows compared to the number of dessert recipes shown,

325 which supports the notion that TV cooking shows do not necessarily focus on nutrition but
326 rather aim toward viewing pleasure (Adema, 2000). The proportions of recipes that met the
327 recommendations for saturated fatty acids and sugar were significantly lower among the dessert
328 recipes compared to all other recipe types. This finding is a concern because a recent study by
329 Neyens and Smits (2017) has shown that the mere exposure to sweet foods via TV cooking
330 shows can increase children's consumption of sugar. Studies such as Neyens and Smits' (2017)
331 warn about the potential effect of TV cooking shows on their audiences, referring to the mere
332 repetitive exposure effects (Zajonc, 2001) and food cue reactivity theories (Boswell and Kober,
333 2016). The latter asserts that exposure to visual foods cues can result in increased cravings for
334 these foods, and explains how children who were exposed to sugar consumption via a TV
335 cooking show also consumed more sugar in the study by (Neyens and Smits, 2017). According to
336 the mere repetitive exposure theory, the repetition of such encounters with visual food cues
337 could result in changes to food preference (Zajonc, 2001; Jansen, 1998).

338 Furthermore, children are likely to be influenced by adult and/or celebrity behaviour
339 that they are exposed to while watching TV cooking shows or indirectly through the show's
340 influence on their parents (Ross *et al.*, 1984; Dixon *et al.*, 2014; Savage *et al.*, 2007). Conversely,
341 exposure to a TV cooking show that endorses fruits and vegetable has been shown to
342 momentarily alter children's food choice behaviour towards fruit and reduce overall appetite for
343 unhealthy food (Ngqangashe *et al.*, 2018). Food preferences and eating habits are shaped in
344 childhood and may persist into adulthood (Branen and Fletcher, 1999; Kelder *et al.*, 1994); thus,
345 it is important to be mindful of the food messages children receive early in life. While the
346 findings of this study cannot say anything definitive about the potential effects of TV cooking

347 shows on children, we can only conclude that the foods in these shows may not represent
348 healthy diet choices.

349

350 *Limitations of this Study*

351 The recipes used in this study were selected based on availability and might not,
352 therefore, be a complete representation of all recipes prepared on different TV cooking shows
353 targeting children. Some of the shows were more than two years old at the time of the analysis;
354 however, this does not make the food messages they contain irrelevant because the recipes
355 books and YouTube clips of the shows are still accessible to consumers. The energy reference
356 intake for children varies depending on age, gender and physical activity; thus, the approximated
357 30% must be interpreted bearing that in mind. As many recipes did not specify the amount of
358 salt or butter to use, a teaspoon was assumed for salt and a tablespoon for butter; these amounts
359 were applied across all recipes for consistency. Furthermore, as no validated academic source
360 exists, an online search engine conversion^[2] was used to convert a pinch of salt into grams. What
361 people use in reality might differ and this has to be taken into account; thus, the salt findings
362 were interpreted with caution and could not be overemphasised. There is no single international
363 guideline against which the recipes could be evaluated; the WHO guidelines used were based on
364 average intakes per day, which limits their applicability to individual recipes, while the FSA
365 guidelines were only specific to the UK, which limits the applicability of their criteria to recipes
366 from other countries. To counter these shortcomings, the researchers used both guidelines and
367 obtained fairly similar results. As consumers may alter recipes by adding, omitting or swapping
368 ingredients, the findings of this study are limited to the foods the audiences are exposed to but

369 not those they consume.

370

371 *Conclusion and Implications for Further Research and Practice*

372 The findings of this study confirm the previous observations that recipes from TV cooking
373 shows and celebrity chefs fall short of the recommendations for healthy eating (Howard *et al.*,
374 2012; Jones *et al.*, 2012; Silva *et al.*, 2010) and necessitate further research on the subsequent
375 effects of these shows on their audiences. The subsequent effects of this exposure are beyond
376 the scope of this study; however, this study lays a foundation for future studies on the effects of
377 TV cooking shows on young audiences.

378 There are multiple opportunities to nudge TV cooking show producers to incorporate
379 health promotion into their shows such as selecting recipes according to the criteria for healthy
380 eating, using health-related themes or adding healthfulness as a criterion for good dishes in
381 cooking challenges. Changing the content of advertisements to promote healthy eating has been
382 found to be effective in improving food healthy food preferences and nutrition knowledge among
383 children (Kraak *et al.*, 2006; Nelson and Kehr, 2016). Furthermore, TV cooking shows could also
384 be used as platforms to endorse healthier dietary choices. A recent study has shown that
385 children's overall preference for unhealthy foods declines and they are more likely to choose a
386 piece of fruit over a popular cookie after exposure to a popular TV cooking show episode that
387 endorses fruit and vegetable consumption (Ngqangashe *et al.*, 2018). Follow up studies should
388 also measure food consumption patterns of children that watch these shows and their
389 subsequent health outcomes. Local health authorities, TV cooking show chefs and producers can
390 collaborate to modify the existing recipes and establish a standard for recipes that can be

391 portrayed on children's TV cooking shows. Small changes such as using more fruits and
392 vegetables, specifying the use of healthier alternatives such as high fibre unprocessed foods
393 would improve the nutritional content of these recipes. All of these actions are timely and
394 necessary, considering the burden of childhood obesity and the on going popularity of TV these
395 shows worldwide.

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12 Foot notes

13 ^[1] (www.nubel.be/eng, 2011)

14 ^[2] (www.wolframalpha.com, 2016).

Tables

Table 1: Representation of the selected cooking television shows whose recipes were analysed

(N=150).

Television show	Country of origin	Season	Year of broadcast	Number of Recipes
<i>Junior Master Chef</i>	Australia	2	2011	42
<i>Junior Master Chef</i>	Belgium	1	2012	31
<i>Junior Master Chef</i>	France	1	2012	29
<i>Junior Master Chef</i>	UK	**	**	8
<i>Junior Master Chef</i>	US	**	**	4
<i>Rachel Ray's Little Cook Off</i>	US	1	2015	11
<i>Matilda & the Ramsay Bunch</i>	UK	1	2016	15
<i>Disney's First Class Chefs</i>	UK	1	2016	10

**Recipes were obtained online and did not have seasons' details

Table 2: The nutrient criteria used to evaluate the recipes at daily and meal intake levels.

	FSA ^a	WHO ^b
Energy (Kcal) ^c	Max 669 kcal	
Total Fat (g)	Max 21g	Max 35%
SFA (g)	Max 6g	Max 8%
CHO (g)	Max 75g	Min 55%
Protein (g)	Max 17g	Max 15%
Sugar (g)	Max 27g	Max 10%
Fibre (g)	Min 7.2g	Min 3%
Salt (g)	Max 1.8g	
Starch portion	Min 1	
Protein	Min 120	
Fruit and vegetables	Min 1	

^a recommendations from FSA guidelines (Benelam & Stanner, 2015)

^b recommendations from WHO recommendations for prevention of diet related chronic disease published in 2003 (WHO, 2003)

^c 30% of energy the mean recommendation by FAO for moderately active girls between the ages of 8 and 18 (FAO, 2001)

Table 3: Median (Interquartile range) of nutrient content of main course recipes (N=111) compared against FSA guidelines (excluding desserts)

	Norm^a	Overall	Seafood (n=36)	Red meat (n=31)	Poultry (n=21)	Vegetarian (n=23)
Energy (Kcal)	670 ^b	485 (341-677)	448(341-677)	562(371-733)	495(388-815)	358(306-578)
Fat (g)	21g	23 (12-36)	23(11-30)	26(11-50)	22(14-37)	21(12-29)
SFA (g)	6g	6 (3-13)	6(3-16)	7(3-13)	7(3-13)	7(3-12)
CHO (g)	75g	30(14-54)	28(10-52)	29(20-45)	27(13-49)	37(15-69)
Sugar (g)	27g	7(4-15)	5(2-12)	6(3-10)	6(6-16)	5(10-14)
Fibre (g)	7.2g	4 (2-6)	3(2-6)	3(2-6)	4(2-6)	5(3-8)
Protein (g)	17g	29(17-44)	34(20-44)	32(24-52)	39(34-50)	14(9-22)
Salt (g)	1.8g	.3(.5-2)	1.3(.6-2)	2(.7-4)	.5(1-2)	.1(.4-1.6)
F & V ^c	120g	73(28-146)	52(5-109)	57(28-114)	87(13-177)	150(85-277)

^a recommendations from FSA guidelines (Benelam & Stanner, 2015)

^b 30% of energy the mean recommendation by FAO for moderately active girls between the ages of 8 and 18 (FAO, 2001)

^cFruits and vegetables

Table 4: Median (Interquartile range) energy proportions derived from each macronutrient against the WHO recommendations (N=150) including desserts

	Norm ^a	Median (IQR) ^c					
		Overall	Seafood (n=36)	Red meat (n=31)	Poultry (n=21)	Vegetarian (n=23)	Dessert (n=39)
	<35%						
Fat		41(28-56)	43(26-60)	52(27-60)	43(31-49)	32(17-52)	40(32-50)
SFA	<8%	13(8-21)	13(7-18)	12(8-25)	13(7-18)	12(6-18)	20(13-30)
CHO	55-70%	36(18-15)	34(13-46)	34(19-45)	32(16-45)	42(14-59)	37(22-51)
Sugar	<10%	9(3-23)	5(2-10)	6(2-10)	5(3-10)	9(5-15)	29(20-46)
Fibre ^b	>3%	2(1-3)	2(1-3)	1(1-2)	1(1-2)	3(1-4)	1(1-2)
Protein	10-15%	17(9-25)	23(19-31)	22(16-32)	26(16-45)	12(9-17)	7(5-12)

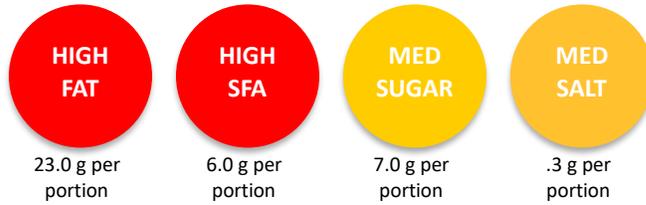
^aWHO/FAO release independent Expert Report on diet and chronic disease, Fats and fatty acids in human nutrition and report of an expert consultation

^bBased on 8.4 MJ/day (2000 kcal/day) diet and recommended daily fibre intake of >25 g

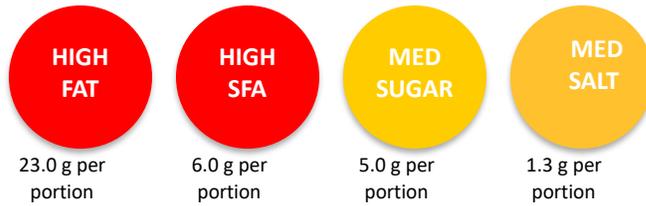
^cIQR – interquartile range

FIGURE 1: FSA traffic light system for the all the recipes and recipe categories.

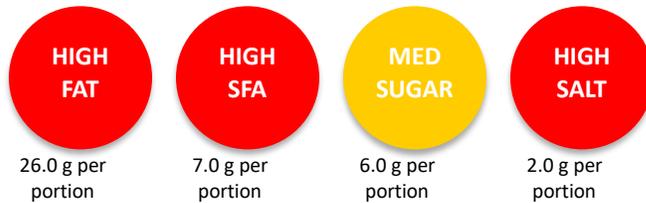
Overall recipes from popular children’s TV cooking shows



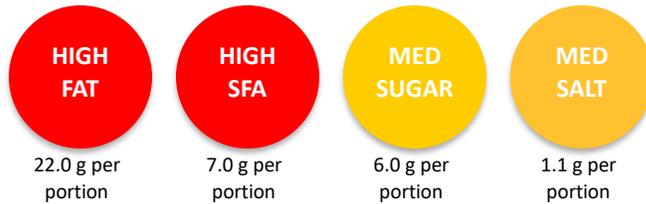
Seafood recipes from popular children’s TV cooking shows



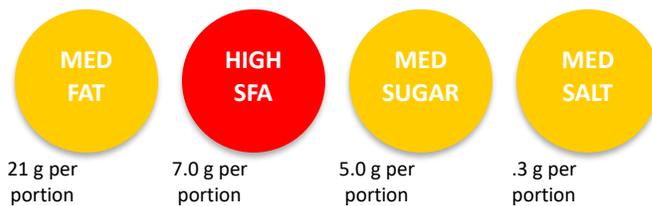
Red meat recipes from popular children’s TV cooking shows



Poultry recipes from popular children’s TV cooking shows



Vegetarian recipes from popular children’s TV cooking shows



Key

	Green	Orange	Red
FAT	<5g	>5<22g	>22g
SFA	<1.5	>1.5<5g	>5g
SUGAR	<5	>5<27g	>27g
SALT	<0.3	>0.3<1.8	>1.8