

1 **Reframing interventions for optimal child nutrition and childhood obesity: the importance of**
2 **considering psychological factors.**

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22 **ABSTRACT**

23 This review aims to emphasise the impact of poor nutrition on children’s health and psychological
24 wellbeing, urging those involved in childhood obesity or nutrition services to broaden their
25 intervention approach. Poor nutrition and childhood obesity affect physical and psychological
26 health. The stress of living with obesity further impacts quality of life, wellbeing and self-esteem.
27 Children living with obesity may experience adverse childhood events and stress, and young people
28 are able to recall the impact of psychosocial issues such as experiencing stigma and discrimination.
29 Food is often a coping mechanism for managing negative emotions, perpetuating cycles of
30 emotional coping and unhealthy eating behaviours. UK guidelines recommend family-based, multi-
31 component weight management interventions for children living with obesity. Interventions mainly
32 target health behaviours and utilise behaviour change techniques attempting to directly improve diet
33 and physical activity as behavioural outcomes. Whilst these interventions may show some
34 improvements in psychological wellbeing, there is limited consideration or understanding of the
35 underlying mechanisms of action which indirectly influence engagement and the sustainability of
36 the behaviour change. Lack of attention and inclusion of psychosocial variables in intervention
37 implementation may help explain the variable effectiveness reported across childhood obesity
38 interventions. In conclusion, enhancing the effectiveness of childhood obesity interventions requires
39 a broader approach that fully incorporates psychosocial factors. Those responsible for
40 commissioning, designing and implementing these interventions should adopt a holistic approach
41 that addresses psychological and emotional needs while incorporating underlying mechanisms of
42 action. This shift in focus could result in more sustainable and comprehensive treatment for
43 childhood obesity.

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52 **Reframing Interventions for optimal child nutrition and childhood obesity: Considering the** 53 **Psychological Factors**

54 This review aims to emphasise the impact of poor nutrition on children's health and psychological
55 well-being, urging those involved in childhood obesity or nutrition services to broaden their
56 intervention approach. A range of evidence is presented which reviews: The importance of
57 childhood nutrition; Childhood obesity and nutrition; The impact of obesity on psychological,
58 psychosocial health and eating behaviour; A mention of mental health- psychiatric diagnosis;
59 Empowering Voices: Children and Young People Living with Obesity; Childhood Obesity
60 Interventions, and finally, a Conclusion which offers a summary of the key issues and calls for
61 health professionals to consider various psychological factors relevant to supporting optimal child
62 nutrition and obesity.

63 **The importance of childhood nutrition**

64 Childhood nutrition plays a crucial role in a child's growth, physical and cognitive development,
65 and overall well-being⁽¹⁾. Healthy eating patterns support disease prevention efforts by reducing the
66 risks of nutritional deficiencies alongside the risks of developing obesity and other non-
67 communicable diseases (such as certain cancers and metabolic disorders). UK evidence suggests
68 that adherence to dietary guidelines during childhood is associated with better health outcomes (for
69 example, improved cardiometabolic profile), suggesting that adopting a healthy diet has long-term
70 benefits to child health^(2, 3).

71 A healthy diet occurs when daily eating patterns include adequate nutrient and energy intake
72 to meet individual energy needs. Optimal childhood nutrition provides ideal quantities of the
73 essential nutrients and energy needed for physical growth and cognitive development. Nutrients
74 such as proteins, vitamins, minerals, and carbohydrates are essential for building strong bones,
75 muscles, and organs, particularly during rapid periods of growth⁽⁴⁾. Micronutrients like omega-3
76 fatty acids, iron, iodine, zinc, and B vitamins contribute to brain and cognitive development,
77 memory, and learning abilities⁽⁵⁾. Nutrient-rich diets positively influence cognitive function,
78 concentration, and academic performance⁽⁶⁾.

79 However, evidence consistently shows that many children have suboptimal diets worldwide,
80 resulting in limited adherence to national and international dietary guidelines⁽⁷⁻⁹⁾. The World Health
81 Organisation (WHO) European Childhood Obesity Surveillance Initiative (COSI) analysed over
82 132,489 diets of children across 23 European countries and reported that fewer than half (42.5%)
83 consumed fruit, and less than a quarter (22.6%) consumed fresh vegetables daily⁽¹⁰⁾. Similar

84 findings have been reported in the UK, with data revealing poor compliance with the UK's dietary
85 recommendations⁽¹¹⁾. Specifically, dietary analysis for implementation of child dietary
86 recommendations is notably very low or low for consumption of free sugars, fish, saturated fat and
87 fibre, as well as for fruit, vegetables and salt. These dietary intakes are suboptimal, and neglecting
88 good nutrition could lead to serious short-term adverse impacts on children's growth, development,
89 and future long-term health. For example, inadequate zinc intake during childhood can lead to
90 detrimental effects on attention and short-term memory⁽¹²⁾. Inadequate iron intake leading to iron
91 deficiency in childhood can negatively impact overall intelligence and cognitive development⁽¹³⁾;
92 there is growing evidence regarding the prevalence of brain disorders such as Attention Deficit
93 Hyperactivity Disorder (ADHD) and iron deficiency during early life^(14, 15). Insufficient vitamin D
94 during childhood has been linked to the onset of various conditions, including rickets, multiple
95 sclerosis (MS)⁽¹⁶⁾ and prediabetes⁽³⁾. Moreover, a diet containing high levels of saturated fat, refined
96 carbohydrates and processed food products is associated with poorer mental health in children and
97 adolescents⁽¹⁷⁾. Furthermore, there is a significant association between mental wellbeing and diet,
98 with lower fruit and vegetable consumption in adolescents showing lower mental wellbeing⁽¹⁸⁾.

99 In addition to these health risks, a poor diet increases the chance of developing childhood
100 obesity⁽¹⁹⁾. Healthy eating and good quality nutrition are promoted as key elements in the
101 prevention of childhood obesity^(20, 21). The European Society for Paediatric Gastroenterology,
102 Hepatology and Nutrition Committee on Nutrition published a position paper on the role of diet and
103 food habits on childhood obesity⁽²¹⁾. This position paper summarises a range of dietary and eating
104 behaviours that may support the prevention of obesity (including for example: breast-feeding;
105 parenting styles; dietary patterns; eating behaviours; meal frequency, composition and portion
106 size)⁽²¹⁾. A similar position paper on this subject is written by the Global Federation of International
107 Societies of Paediatric Gastroenterology, Hepatology and Nutrition (FISPGHAN)⁽²⁰⁾. Whilst there
108 are clear nutritional guidelines and position statements aimed at promoting healthy eating and
109 preventing obesity, it is concerning to observe that children globally and in the UK are not
110 consistently following these recommendations; this presents significant future public health risks as
111 these children transition into adulthood. Interventions to encourage nutritious diets and healthier
112 eating habits to date have yielded varying levels of success.

113 **Key learning point:** Nutrient deficiencies and poor diets have consequences which include
114 various psychological and cognitive challenges (to recap: having a negative impact on brain and
115 cognitive development⁽⁵⁾, cognitive functioning, concentration, memory⁽⁶⁾, attention⁽¹²⁾,
116 intelligence⁽¹³⁾, poor mental health⁽¹⁷⁾ and lower mental wellbeing⁽¹⁸⁾, links to ADHD^(14, 15), and

117 lower academic performance⁽⁶⁾). Hence healthcare and public health professionals need to consider
118 how they assess these psychological and cognitive needs, and how any challenges associated with
119 such needs are integrated into population based or targeted interventions. The WHO⁽²²⁾ has
120 recognised that healthy eating interventions, for example, in school settings, must go beyond
121 measuring physical outcomes (i.e. diet) and include cognitive and academic outcomes as part of
122 their evaluations. Despite ongoing efforts to promote healthy eating and prevent childhood obesity,
123 the yearly increase in childhood obesity rates worldwide highlights the need for more effective
124 strategies and interventions.

125 **Childhood obesity**

126 In 2015, 107.7 million children were living with obesity worldwide⁽²³⁾, and in 2018, the WHO
127 reported that childhood obesity is one of the most serious challenges of the 21st century⁽²⁴⁾.
128 Childhood obesity has profound and wide-ranging impacts on an individual's health⁽²⁵⁾. These
129 effects can manifest both in the short term, have long-term implications into adulthood, and may
130 significantly impact morbidity and mortality⁽²⁶⁻²⁸⁾. Specifically, children living with obesity are at
131 higher risk of developing type 2 diabetes⁽²⁹⁾ and increased risk of developing cardiovascular
132 diseases⁽³⁰⁾ such as high blood pressure, high cholesterol levels, and atherosclerosis later in life.
133 Non-alcoholic fatty liver disease (NAFLD) is more common in children living with obesity and can
134 lead to inflammation and liver damage⁽³¹⁾. Childhood obesity can affect bone development and
135 increase the risk of fractures⁽³²⁾. Excess weight places additional stress on the joints and may lead to
136 osteoarthritis and musculoskeletal pain⁽³³⁾. Obesity can contribute to respiratory problems like
137 asthma and sleep apnoea, further impacting a child's overall health and quality of life⁽³⁴⁾. Oral
138 morbidity is increased in children and adolescents with obesity. Conditions like gastroesophageal
139 reflux disease (GERD) and gallstones can be more common in children living with obesity⁽³⁴⁾.
140 Childhood obesity also increases the risk for autoimmune diseases such as multiple sclerosis,
141 Crohn's disease, arthritis, and type 1 diabetes⁽³¹⁾. Obesity can disrupt hormonal balance, potentially
142 leading to conditions like polycystic ovary syndrome (PCOS) in girls and may contribute to early
143 puberty, which might carry additional physical and emotional challenges⁽³⁴⁾. Children living with
144 obesity are more likely to become adults with obesity, further increasing the risk of chronic
145 diseases, such as cancer⁽³⁵⁾. The combination of obesity-related health issues can reduce life
146 expectancy and overall quality of life.

147 *Obesity and Nutrition:* For those already living with overweight or obesity, promoting and
148 supporting a healthy diet has been recommended as a priority⁽³⁶⁾. Specifically, for those living with
149 obesity, dietary improvements such as reducing the consumption of energy-dense foods, processed

150 foods and sugar drinks are among some of the modifiable behaviours recommended^(37, 38). Children
151 living with obesity are reported to have low vitamin D^(3, 39, 40), low iron^(41, 42) and various other
152 deficiencies (and the impact of these deficiencies is described above).

153 **Key learning point:** In addition to the nutritional challenges facing the general population,
154 children living with obesity are at much higher risk of current and future health issues. This should
155 be considered with reference to the 'double burden malnutrition' phenomenon, defined by WHO as
156 the '*coexistence of under nutrition along with overweight, obesity or diet-related non-communicable*
157 *disease*⁽⁴³⁾. Double burden malnutrition can exist at an individual, household or population level.
158 Globally, children in low-income households are more likely to experience deficiencies of essential
159 micronutrients (such as iron), alongside living with overweight and obesity. However, double
160 burden malnutrition is more common in middle-income countries, experiencing rapid changes in
161 economic circumstances and access to food⁽⁴³⁾. Promoting good nutrition and healthy eating habits
162 must address all forms of malnutrition.

163 **The impact of obesity on psychological, psychosocial health and eating behaviour**

164 There is clear evidence highlighting the co-directional relationship between psychological
165 wellbeing and childhood obesity⁽⁴⁴⁾. Children living with obesity are frequently exposed to
166 psychological stress, such as stigmatisation, discrimination, teasing, bullying^(45, 46) and other forms
167 of social marginalisation. These and other psychological stresses expose children to additional
168 emotional and physical impacts, such as reduced quality of life, lower self-esteem, lower self-worth,
169 depressive symptoms, body dissatisfaction, functional impairment (for example, less agility, limited
170 ability to engage in activities) adverse social functioning, social withdrawal, difficulties in forming
171 and maintaining peer relationships^(47, 48), as well as difficulties communicating and lower academic
172 achievement^(49, 50), all of which may further affect their physical, psychosocial health, quality of life
173 and wellbeing.

174 The impact of psychological factors on children living with obesity is highly variable.
175 However, given the wide range of factors that could be impacted, further consideration, assessment,
176 and intervention should be integrated into childhood weight management and healthy eating
177 interventions. For example, not all children living with obesity recognise their diagnosis or accept
178 this as a negative view of their body image⁽⁵¹⁾. However, negative body image can be evident for
179 some children living with obesity. Cognitive factors such as self-identity, attitudes, beliefs and
180 knowledge about obesity, food, nutrition and healthy behaviours can influence decisions, including
181 food choice⁽⁵¹⁾.

182 In a review of the link between stress and childhood obesity⁽⁵²⁾, stress has been highlighted
183 as a significant factor in contributing to and maintaining childhood obesity⁽⁵³⁾. Children living with
184 obesity are more likely to experience stress at home, and daily stresses significantly impact their
185 eating behaviours⁽⁵⁴⁾. Food can be a coping mechanism for dealing with stress, anxiety, or other
186 negative emotions, and can lead to a cycle where eating becomes associated with emotional coping.
187 Stress can be defined as a “negative response that results from threatening stimuli, external events
188 or conditions that adversely affect a person's well-being”⁽⁵²⁾ (for example, experiencing social
189 discrimination, stigma, teasing or bullying for those living with obesity). Stress is considered in the
190 context of chronic (ongoing prolonged) stress, and acute stress (brief stress), and its impact on
191 childhood obesity risk. Stress can influence behaviour and affect psychological wellbeing; it can
192 promote changes in sleep, cognition, and perception of pain and may change biological responses
193 such as endocrine, immune and metabolic functioning⁽⁵⁵⁾. The cause-and-effect debate regarding
194 stress and obesity is still under investigation (as are many psychological variables), but stress and
195 obesity are entwined. The Obesity Medicine Association (2022)⁽⁵⁵⁾ has produced a clinical practice
196 statement which summarises the links between obesity, stress and psychiatric disease (focusing on
197 adult literature). Which suggests that obesity and its negative health effects can heighten both
198 physical and mental stress, potentially leading to unhealthy behavioural changes. These changes in
199 biological functions, including the endocrine, immune, and metabolic systems, contribute to a cycle
200 of worsening obesity, a process known as an adiposopathic stress cycle⁽⁵⁵⁾ (i.e. ‘sick-fat’, see Bays
201 et al.,⁽⁵⁶⁾ for further information on this topic).

202 A possible link to the stress response is poor emotional regulation. In this context, the
203 behaviours and actions of the child living with obesity are influenced by their emotions, how they
204 experience these emotions, and how they communicate them to others. Ineffective emotional
205 regulation has been modelled to link stress and obesity, suggesting that stress and ineffective
206 emotional regulation lead to unhealthy eating behaviours such as emotional eating and other
207 maladaptive behaviours, such as sleep difficulties or reduced physical activity⁽⁵⁷⁾. For example,
208 adolescents who have higher levels of stress are more likely to engage in emotional eating⁽⁵⁸⁾.
209 Psychological factors can profoundly impact a child's relationship with food, eating patterns, and
210 overall health. Additional emotional factors, such as boredom, sadness, and happiness, can trigger
211 eating behaviours⁽⁵⁹⁾. Children may turn to food for comfort or to cope with their emotions, which
212 can lead to overeating or consuming unhealthy foods. Children living with obesity are reported to
213 experience higher levels of emotional eating⁽⁵²⁾. A clear summary of emotional-induced eating
214 (emotional eating), dietary restraint, stress and eating behaviour, and family, parental and
215 environmental stress are identified as possible contributing factors to childhood obesity⁽⁵²⁾.

216 There are biological (genetic/physiological) factors which are significantly associated with
217 taste preferences and subsequent consumption of specific food types (for example, sweet, bitter and
218 fat tastes⁽⁶⁰⁾). Children with higher body mass index are reported to have bitter taste sensitivity, and
219 girls may present with low sensitivity to sweet taste⁽⁶¹⁾. Some of these biological mechanisms are
220 apparent through the activation of various areas within the brain (including the frontal, parietal,
221 occipital, and temporal lobes, as well as the hypothalamus, thalamus, amygdala, hippocampus, and
222 ventral tegmental areas), all of which can be influenced and activated by specific foods, especially
223 those rich in sugar, fat, and salt⁽⁵⁵⁾. Activation of these areas in the brain, may directly impact eating
224 behaviours, triggering cravings and initiating a cycle of seeking out specific foods for their
225 pleasurable effects⁽⁵⁵⁾. For example, a cross-sectional study on adolescents living with obesity
226 reported that nearly half (47.9%) met a food addiction diagnosis⁽⁶²⁾. Food addiction has been linked
227 to impairment of the brain reward circuits⁽⁶³⁾ and research into the field of obesity and food
228 addiction in adolescents suggests that such occurrences increase the likelihood of adolescents
229 reporting significant increased anxiety of gaining weight, dieting, and thin body preoccupation⁽⁶²⁾.
230 Biological factors can change taste preferences and directly impact eating behaviour, and early
231 experiences with food can also shape an individual's food choice preferences⁽⁶⁴⁾. In addition, to
232 biological, cognitive and psychological factors, eating patterns may also be influenced by social,
233 environmental and cultural factors, such as group norms, peer pressure, parenting practices and the
234 desire to fit in^(51, 65). Children's eating habits are influenced by their social circles, including family,
235 friends, school teachers and peers. Psychological factors can play a role in forming and maintaining
236 these habits, whether they are healthy or unhealthy.

237 **Key learning point:** Individual interventions to promote healthy eating or support weight
238 management, in the case of those living with obesity, need to consider how they help children
239 navigate all these possible influences. The underlying, complex, and various biological mechanisms
240 for the development (and maintenance) of childhood obesity need to be accounted for in future
241 obesity prevention and treatment interventions. Understanding the interplay between various
242 psychological factors and eating habits is essential for promoting healthy eating and achieving
243 optimal weight management behaviours for those living with obesity. Strategies addressing
244 emotional eating, promoting self-awareness and encouraging a positive relationship with food,
245 which can contribute to more balanced eating habits.

246 **A mention of mental health- psychiatric diagnosis**

247 According to the Mental Health of Children and Young People in England survey⁽⁶⁶⁾ in 2022,
248 around 18% of children aged 7-16 had a probable mental health disorder leading to poor social and

249 economic outcomes. These mental health diagnoses included clinical depression, clinical anxiety,
250 eating disorders including binge eating, and ADHD. The number of children seeking help for
251 mental health concerns has risen in the UK. About 50% of lifelong mental health issues start by age
252 14, making it crucial to explore the connection between childhood obesity and childhood mental
253 health⁽⁶⁷⁾. Negative experiences during childhood, such as abuse, parental stress, trauma, and
254 family discord, have been linked to behaviours that contribute to weight gain. The higher the
255 exposure to psychological adversity, the greater the risk of developing obesity⁽⁶⁸⁾.

256 Several reviews have evaluated research on the onset or co-morbidity of mental health and
257 childhood obesity^(48, 69). For example, a systematic review and meta-analysis evaluated data from
258 143603 children and reported that the prevalence of clinical depression among children living with
259 obesity was 10.4%⁽⁷⁰⁾. The review suggested that children who perceive themselves as having
260 obesity, can develop negative body image, leading to depression. Moreover, the analysis found that
261 females living with obesity had significantly higher odds of concurrent and future depression
262 compared with females not living with obesity, but this finding was not the same for boys⁽⁷⁰⁾. In
263 boys, the connection between body dissatisfaction and BMI is more complex; for example, boys
264 may be more likely to underestimate their weight or not recognise obesity⁽⁶⁹⁾. Another review
265 evaluating the psychological consequences of childhood obesity⁽⁴⁸⁾ highlighted that there is limited
266 research that separates out gender and childhood obesity, but also that boys living with obesity are
267 at higher risk of depression compared to boys of normal weight. The evidence for the direct
268 association between clinical anxiety and childhood obesity is more uncertain, although children
269 living with obesity are likely to be at increased risk of developing anxiety⁽⁴⁸⁾.

270 There is further evidence to link obesity to co-morbidity of emotional and behavioural
271 disorders (e.g., ADHD) and eating disorders. Adolescent girls living with obesity are more likely to
272 engage in extreme weight-control behaviours, such as vomiting, using laxatives, fasting, or other
273 methods, which may lead to restrictive eating disorders⁽⁷¹⁾.

274 The relationship between the cause and effect of childhood obesity and the various
275 psychopathologies, however, remains inconclusive⁽⁴⁸⁾. Evidence across this field can be
276 contradictory, possibly due to analysing confounding variables differently, considering a variety of
277 psychometric variables, or target populations (clinical versus community populations, overweight
278 versus obese etc.). It is noteworthy that mental health diagnosis or symptomology is not a given for
279 those living with childhood obesity, and many children do not experience these issues.

280 **Key learning point:** It is important to understand and consider possible co-directional
281 relationships between the mental health and psychological needs of children living with obesity⁽⁷²⁾.

282 Given this varied evidence, prevalence, cause or consequence, children living with obesity should
283 be assessed and monitored for mental health symptomology and screened for appropriate treatment
284 (before, during and after any intervention for childhood obesity). If a child or adolescents meets
285 pathway criteria for onwards referral to psychological support services, this should be supported.
286 However, if an onwards referral is not made (for whatever reason), or the mental health challenges
287 are not considered (prior to, or after onwards referral) at a level for psychological therapy, then
288 those delivering weight management or nutrition interventions should remain aware of, and
289 considerate of these individual psychosocial challenges.

290 **Empowering Voices: Children and Young People Living with Obesity**

291 Despite the evidence that psychological challenges may impact children living with obesity, there is
292 limited evidence regarding their reported experiences, perceptions, and reflections on living with
293 obesity and their emotional and psychological needs.

294 However, children and adolescents are insightful to their experiences of living with obesity
295 and can offer valuable reflections on their experiences which we should learn from and integrate
296 their opinions, experiences and needs back into our healthcare services and interventions. For
297 example, in a UK study⁽⁷³⁾, adolescents living with obesity reflected on their experiences of
298 engaging in the national healthy school programme within their secondary school environment and
299 how this general promotion of healthy eating to all school children reinforced their vulnerability to
300 bullying, stigmatisation and social isolation within the school environment. It is important that
301 strategies to engage in population-based health promotion activities, consider the impact (possibly
302 negative) and prior to implementation, action is taken to mitigate possible negative impacts, in this
303 case for those who may have difficulties engaging in healthy eating behaviours or who are living
304 with obesity. Better still, it would be best practice to involve those living with obesity or
305 experiencing challenges implementing healthy eating interventions, to be part of the co-design of
306 any such population-based health promotion activities.

307 A recently published and significant study is the ACTION Teens global survey⁽⁷⁴⁾ which
308 evaluated various psychological factors and considered the lived experiences of adolescents living
309 with obesity. Survey data was collected on 5275 adolescents living with obesity from 10 countries.
310 The study reported that two-thirds of the adolescents living with obesity considered it comparable
311 or more impactful than living with another serious health condition, such as cancer, heart disease,
312 diabetes, depression, and anxiety⁽⁷⁴⁾. Most of the adolescents perceived their weight as ‘above
313 normal’, thus indicating they recognised their status as living with obesity; 85% reported being
314 worried about its impact on their health, and a significant number had attempted weight loss

315 recently. Nearly half of adolescents indicated that their weight frequently or always caused
316 unhappiness (44%), and their body often or always made them feel insecure (37%)⁽⁷⁴⁾. With
317 reference to eating behaviour specifically, the adolescents acknowledged a lack of hunger control as
318 the greatest difficulty in achieving weight loss, followed by a lack of motivation and enjoyment of
319 unhealthy food as the most significant weight loss barriers. This study reported that over two-thirds
320 of adolescents said they could lose weight if they ‘set their mind to it’ and that weight loss was
321 entirely their responsibility. Finally, adolescents living with obesity defined successful weight loss
322 as ‘feeling better about themselves’⁽⁷⁴⁾.

323 Adolescents living with obesity and attending weight management interventions have
324 acknowledged the benefit of receiving support to improve their wellbeing and self-esteem and
325 valued intervention input beyond focusing on weight-loss behaviours⁽⁷⁵⁾. Adolescents desire to lose
326 weight has been motivated by a feeling of being proud and being normal, improving their social
327 acceptance and activities, not wanting to be like other overweight people (especially family
328 members), reflecting on past negative experiences, and not wanting to experience bullying but to be
329 happy⁽⁷⁵⁾. A qualitative systematic review⁽⁷⁶⁾ has summarised the perceptions and reflections of
330 adolescents living with overweight or obesity attending lifestyle obesity treatment interventions,
331 and one of the outcomes acknowledged that adolescents were greatly driven by the desire to
332 enhance their body image and increase social desirability. This evidence explores adolescent’s
333 experiences and highlights how psychological and emotional factors shape their perceptions,
334 experiences, and support needs while living with obesity. It also underscores the impact of these
335 factors on their eating behaviours.

336 Younger children are also able to offer valuable insight into their experiences of living with
337 obesity. A UK qualitative study⁽⁵¹⁾ explored the beliefs and experiences of attending a multi-
338 component family-based childhood obesity intervention. The analysis examined children’s (aged 5-
339 15 years old) expectations of attending the weight management intervention and how this
340 influenced subsequent behaviour (such as engagement in dietary change). Families who predicted
341 that the intervention would have positive effects on their lives were more likely to attend, believing
342 that it would help parents seek support from other parents, help children to make friends, improve
343 their social relationships and self-confidence and facilitate the parents and children to gain new
344 skills and knowledge. However, families who did not attend, emphasised their existing
345 understanding of healthy eating and did not recognise the benefits of attending such a service. In
346 comparison to the adolescents from the ACTION Teens global survey⁽⁷⁴⁾, in this study, the younger
347 children and families made social comparisons to others with obesity, but primarily sought to
348 downplay the severity of their obesity, and made social comparisons to distance themselves from

349 other children living with obesity, and also compared obesity to more serious conditions, such as
350 cancer.

351 **Key learning point:** This evidence highlights the importance of understanding the
352 psychological perspectives and needs of those referred into a weight management intervention, and
353 that healthcare professionals should help individuals acknowledge and reflect on their needs, that
354 may include psychological changes (in addition to physical behaviour change, i.e. diet/ physical
355 activity). Children and young people offer insight towards understanding the factors that influence
356 their behaviours and decisions in attending, engaging, and implementing the advice from weight
357 management and healthy eating interventions. The psychosocial challenges and factors
358 acknowledged from the young people are noteworthy, and they describe how these factors may or
359 may not be addressed through the current interventions available.

360 **Childhood Obesity Interventions**

361 The current UK recommendations for children living with obesity are to attend a family-based
362 multi-component weight management intervention⁽⁷⁷⁾. Multi-component refers to programmes that
363 focus on a combination of behavioural outcomes such as achieving healthy eating, optimal
364 nutrition, increased physical activity, reduction in sedentary behaviours, and health outcomes such
365 as reducing BMI or improving cardiovascular markers. The intervention may utilise a range of
366 behaviour change techniques (BCTs) aimed at impacting directly and indirectly (see mechanisms of
367 action below) on these behavioural outcomes⁽⁷⁸⁾. A review⁽⁷⁹⁾ analysing 217 childhood obesity
368 interventions found that most studies report weight change as the primary outcome. Despite offering
369 a behavioural intervention, only half (48%) of the studies reported behavioural outcomes, such as
370 assessing changes to moderate-to-vigorous physical activity, reductions in television viewing, and
371 improvements in dietary intake⁽⁷⁹⁾. Notably, only 20% of the studies systematically reported
372 psychosocial outcomes, with the most common being quality of life, and only 5% of the studies
373 recorded mental health outcomes (such as depression)⁽⁷⁹⁾. Hence, psychological health (as outlined
374 previously) is not typically the primary focus of childhood obesity, weight management or healthy
375 eating interventions. However, self-esteem is included in UK National Institute of Health and Care
376 Excellence (NICE)⁽⁷⁷⁾ clinical guidelines which recommends including self-esteem as a possible
377 intervention outcome.

378 A more recent umbrella meta-analysis, reanalysed data from 26 other meta-analyses, and
379 summarised the outcomes and various components of childhood obesity interventions⁽⁸⁰⁾. Across
380 the studies, the components of the interventions were often categorised into different "types" of
381 support, such as diet-only, diet combined with physical activity, lifestyle-only, lifestyle combined

382 with diet, and diet combined with physical activity and sedentary behaviour. Typically, childhood
383 obesity interventions tended to prioritise diet and physical activity, with the term "lifestyle"
384 encompassing other aspects. However, it can be argued that this approach does not adequately
385 consider the psychological or emotional aspects of intervention types. Given the various
386 psychological and emotional needs of children living with obesity, as previously described within
387 this review, it is limiting that psychological components in the intervention design are rarely
388 considered⁽⁸⁰⁾.

389 Numerous analyses and meta-analyses have assessed the effectiveness of childhood obesity
390 interventions, but their success rates vary across studies^(79, 81-83). Evidence shows that participating
391 in interventions promoting behaviour change outcomes, such as increased physical activity and
392 good nutrition and implementing various BCTs, is associated with improved psychological
393 outcomes^(17, 18). This evidence appears to be echoed through some of the reflections given by
394 children and adolescent's perceptions of their lived experiences (See earlier considerations above).
395 Furthermore, evidence suggests that participating in childhood obesity interventions may also
396 improve psychosocial functioning⁽⁸⁴⁾. For example, attendance at weight management interventions
397 for those living with obesity was found to reduce the prevalence and risk for eating disorder
398 symptomology⁽⁸⁵⁾.

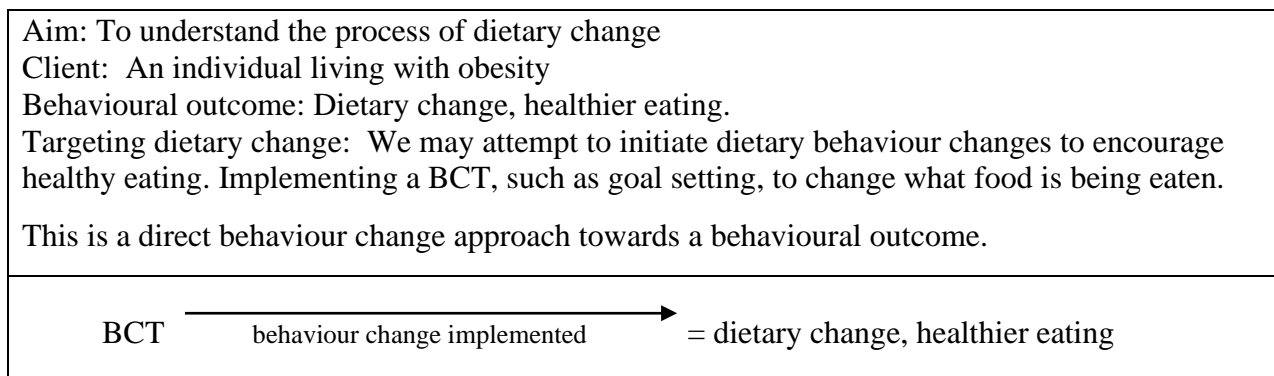
399 A systematic review⁽⁸⁶⁾ of BCTs (using an adapted CALO-RE BCT taxonomy⁽⁸⁷⁾) assessed 9
400 childhood obesity weight management interventions and 8 obesity prevention interventions. Of the
401 9 childhood obesity management interventions, 6 were deemed effective in terms of achieving
402 weight change and 4 out of 8 were effective for the preventative interventions⁸⁶. The analysis of
403 BCTs utilised, found that of the 41 BCTs available, on average interventions used 7.5 BCTs.
404 Techniques commonly used in effective weight management interventions included: individual
405 information; environmental restructure; role model; stress management; communication skills; and
406 practice. It is not known from the evidence base which BCTs are effective, or which combination
407 of BCTs should or should not be included within a given intervention. However, it is noteworthy
408 that there is limited focus on specific support to change psychosocial challenges, only two of the
409 interventions reported using stress management/emotional control training, and one reported using
410 motivational interviewing as a specific BCT, though not effective. Whilst childhood obesity
411 interventions focus on behaviour change outcomes, the consistency, application and effectiveness of
412 using various techniques available is questionable in intervention design and implementation.
413 Another review⁽⁸⁸⁾, which focused on obesity prevention promoting feeding practices in children
414 under 2 years of age, also reported the utilisation of BCTs in the intervention implementation. This

415 review found a limited number and range of BCTs were adopted, and the review also questioned the
416 theoretical underpinning and application of such theory in intervention delivery⁽⁸⁸⁾.

417 If interventions do focus on behavioural outcomes and therefore apply behaviour change
418 methods, understanding the concept of behaviour change and how BCTs operate in such
419 interventions is worth unpicking. BCTs might include methods such as goal setting, problem-
420 solving, knowledge and information, or self-monitoring⁽⁷⁸⁾, and are directed towards a specific
421 behavioural outcome, for example, achieving healthy eating. The BCTs themselves are thought to
422 directly impact the behavioural outcome (i.e., If a specific behaviour change technique (BCT), such
423 as setting goals for dietary planning, is implemented, the intended behavioural change—in this case,
424 dietary modification—will take place). However, given the varied success of interventions (which
425 report implementing BCTs), it is evident that the behavioural outcomes are not always achieved, or
426 indeed may be achieved but are not sustained in the longer term.

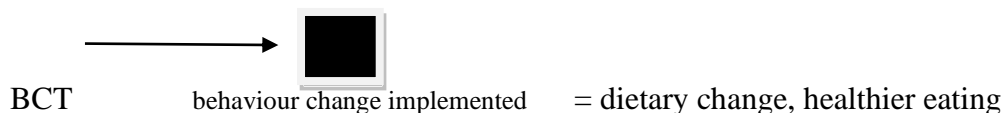
427 BCTs can also act on a behavioural outcome indirectly. This can be explained in terms of
428 the BCTs processes of change or mechanisms of action, which target predictors of behaviour (or
429 determinants)^(89, 90). Determinants are psychological variables or regulatory processes that are causal
430 antecedents of the target behaviour change and subsequently impact the behavioural or health
431 outcomes⁽⁹¹⁾. In other words, the BCT may engage in a mechanism of action that triggers, enhances
432 or engages various factors. It is here that BCTs have the potential to influence psychological
433 variables (such as some of those mentioned earlier, e.g., self-esteem, self-confidence). See example
434 in Table 1 below.

435 **Table 1: A simple illustration to understand mechanisms of behaviour change to impact on a**
436 **behavioural outcome- dietary change (healthier eating).**



However, the change in dietary behaviour may not be achieved successfully or may not be sustained.

There is a block, interference or other process preventing the implementation of the behaviour change.



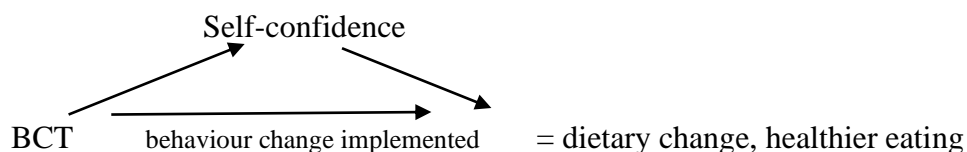
If we consider, why that behaviour has not been implemented or why might the behaviour not be sustained. Ask, what is happening for this individual?

Re-consider client: client has low self-confidence.

Then we may reconsider our approach- to target the self-confidence, as a determinant of the behavioural outcome (dietary change).

To use the BCT to set goals, to help improve and recognise self-confidence (e.g, in ability to cook, choose healthy foods, to choose healthy food at times of stress, other as appropriate to the needs of the client).

Then through its mechanism of action, the BCT might effectively engage and enhance the person's self-confidence.



Consequently, the individual may gain a heightened sense of assurance in their capacity to make healthier dietary choices.

This improvement in self-confidence, set in motion by the BCT, has the potential to indirectly steer the person's behaviour toward adopting and maintaining a healthier diet.

This, in turn, contributes to endeavours aimed at managing and preventing obesity.

*this is a very simple example, though an individual may be operating a number of mechanisms of action.

437

438 Although the contributing role of various psychosocial factors is known, there are few
439 interventions which focus specifically on supporting the psychological needs of children living with
440 obesity. However, some research has shown psychological approaches to be effective. For example,
441 a multi-component intervention employed cognitive-behavioural techniques, together with nutrition
442 education and the promotion of physical activity, and demonstrated positive outcomes for children
443 (aged 6-12 years old) living with obesity. These successful outcomes included BMI change,
444 reduced energy intakes, and improvements in lifestyle habits, emotional and social problems at 5

445 years follow-up⁽⁹²⁾. Other interventions applying cognitive-behavioural /skill building techniques
 446 have also reported successful outcomes^(93, 94). UK Clinical guidelines, NICE^(77, 95) recommend
 447 using BCTs, positive parenting skills, diet changes, and physical activity routines. The intervention
 448 should be tailored to the need of the child and also include both the child and parents. NICE⁽⁹⁵⁾
 449 acknowledges the role of BCTs within interventions (such as self-monitoring, stimulus control and
 450 goal-setting), and calls for more evidence to explore the psychological interventions and methods
 451 which may help improve outcomes for those attending weight management interventions. It is
 452 important to note that NICE recognises that adolescents living with obesity are more likely to
 453 experience emotional and behavioural problems, diminished quality of life, and behaviours like
 454 binge eating compared to adolescents with a healthy weight^(77, 95). However NICE guidance⁽⁹⁵⁾ does
 455 not provide healthcare professionals with specific instruction on how to recognise individual needs,
 456 or when or how to support their psychological, cognitive or emotional needs. Further NICE⁽⁹⁵⁾
 457 suggests that consideration of psychological aspects is 'beyond the scope' of their guidance. It
 458 could be interpreted therefore that psychological needs of children living with obesity are
 459 considered beyond the scope of childhood obesity interventions, which would be a very narrow and
 460 limited view and may help explain the lack of inclusion and guidance for health professionals
 461 implementing psychological support into interventions.

462 To consolidate this evidence and establish a meaningful comprehension, we can utilise the
 463 behaviour science COM-B⁽⁹⁶⁾ (Capability, Opportunity, Motivation-Behaviour) model (as
 464 summarised in Table 2). This model allows us to dissect childhood obesity interventions, revealing
 465 potential gaps in achieving a personalised approach to treatment in not fully considering the
 466 psychological and emotional needs of children with obesity.

467 The COM-B model suggests that for a given behaviour to occur, an individual must have the
 468 capability and opportunity to engage in the behaviour, and the strength of motivation to engage in
 469 the behaviour must be greater than for any other competing behaviour⁹⁴. Considering the
 470 psychological factors of childhood obesity becomes imperative in this context, as capability,
 471 opportunity and motivation play a crucial role in shaping behaviour and behaviour change for those
 472 living with obesity.

473 *Table 2 An example of utilising the COM-B model⁹⁴ to highlight weaknesses in current childhood obesity intervention, regarding*
 474 *lack of consideration for psychological and emotional support, embedded with the behaviour change mechanism of action.*

COM-B component.	Explanation	Application of COM-B element with reference to childhood obesity evidence
Capability	Refers to an individual's	Current interventions mainly focus on

	<p>psychological and physical capacity to engage in the behaviour. Physical capability considers if an individual possesses the necessary knowledge and skills required to perform the target behaviour. Psychological capability refers to an individual's capacity to engage in the required thought processes, comprehension, and reasoning to perform the target behaviour.</p>	<p>enhancing individuals' capability by providing information and skills related to healthy eating, and physical activity.</p> <p>However, they often neglect the psychological capabilities, like self-worth coping strategies, management of stigma, etc. that can significantly impact one's ability to maintain healthy behaviours. Children living with obesity, may experience a range of cognitive, emotional and psychological challenges (attention, memory, concentration, learning abilities) that reduce their capability to engage in the target behaviour.</p>
Opportunity:	<p>Opportunity refers to the physical and social external factors that influence or prompt behaviour. Physical opportunity is influenced by the built environment and social opportunity is influenced by the cultural context that dictates how individuals think about things</p>	<p>Interventions primarily address the physical environment's opportunities (e.g., access to healthy foods). Although, they may miss the opportunity to create supportive psychosocial environments that help individuals deal with emotional barriers, like anxiety, bullying, stigma; or the social perceptions of obesity).</p>
Motivation:	<p>Motivation refers to all the cognitive processes that initiate and direct behaviour, not just goals and conscious decision-making.</p> <p>Reflective motivational processes (evaluations and plans) and automatic motivational processes (emotions and impulses).</p>	<p>While interventions aim to motivate behaviour change, they may not adequately consider the complex motivations related to psychological wellbeing. Whist interventions may promote BCT to set goals and plan for dietary change (reflective motivational processes). Interventions may be missing aspects which address the automatic motivational processes, such as the desire to improve self-esteem or reduce</p>

		stress, reduce low mood symptomology, or recognise biological drivers on their motivations (e.g., cravings/addictions) for eating specific foods etc.
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475

476 **Conclusion**

477 This review has highlighted various impacts of poor nutrition on clinical and psychological
 478 wellbeing. The impacts of childhood obesity on health and psychological wellbeing are also
 479 outlined. Significantly flagged by the WHO⁽⁴³⁾ is the double burden of malnutrition which is
 480 apparent, though little attention has been given to this in the childhood obesity literature.⁽⁹⁷⁾

481 Given the numerous and intricate health impacts linked to both the causes and consequences
 482 of obesity, it is crucial *for health professionals to assess individual needs, inclusive of*
 483 *psychological and emotional needs, and for the design and implementation of childhood obesity*
 484 *interventions to incorporate these varied needs.* Childhood obesity interventions typically centre
 485 around BCTs aimed at directly altering health behaviours, such as adopting a healthy diet.
 486 However, this approach may overlook the underlying mechanisms responsible for driving these
 487 behaviours and how these might be changed (see example described previously). Consequently, the
 488 success of adopting new behaviours tends to be limited and not sustained over time. BCT
 489 mechanisms of action operate indirectly, meaning that BCTs should not only target the behavioural
 490 outcome itself, but also engage these underlying mechanisms. For instance, it might involve
 491 addressing issues like low self-esteem, anxiety, low confidence, or providing coping mechanisms to
 492 manage bullying. *When addressing childhood obesity it's imperative that interventions address*
 493 *these psychological needs through the mechanisms of action.* Unfortunately, this aspect is currently
 494 lacking in childhood obesity treatment interventions, and this is evident in the feedback from
 495 children and adolescents living with obesity in their reflections, evaluations and expectations of
 496 treatment interventions^{(51) (74)}.

497 Further research is required to explore the psychological and emotional mechanisms of
 498 action within the behaviour change interventions for treating and preventing obesity. It would be
 499 helpful to develop an assessment checklist or other resources to assist health professionals in
 500 considering the various health, psychological and cognitive needs of individual children living with
 501 obesity. However, in the absence of such tools, clinicians and other health professionals working
 502 within the field of childhood obesity, or indeed more broadly promoting health behaviours such as

503 dietary change, *should be mindful of these various causes and consequences of obesity, and*
504 *therefore should evaluate their intervention offer, to ensure that it is personalised to meet the*
505 *(changing) psychological and emotional needs of individuals, and thereby provide a comprehensive*
506 *offer which may be more likely to change their health and lifestyle behaviours. Health*
507 *professionals may find it helpful to utilise the COM-B model as an initial step to evaluate their*
508 *intervention offer, and consider if there are additional ways that they could tailor their intervention*
509 *towards meeting individual needs.*

510 It is important to note that the impact of psychological and psychosocial variables on a child
511 or adolescent living with obesity can vary widely⁽⁹⁸⁾. Some children living with obesity have no
512 adverse psychological or psychological impairments. Others are significantly negatively affected
513 with co-morbid mental health (e.g., depression, anxiety, eating disorders), whilst others are not.
514 Some children and adolescents have lower self-esteem and confidence or experience higher levels
515 of stress, stigma, bullying and teasing, with poor coping and communication skills, whilst others do
516 not. Psychological factors, symptomology, and mental health presentation, can change overtime⁽⁹⁸⁾.
517 *There is a need to investigate and assess the individual needs and experiences of each child or*
518 *adolescent living with obesity using objective measures. Once that assessment has explored these*
519 *issues, an appropriate personalised intervention can be offered (recommendation to utilise a model*
520 *such as COM-B to help assess and formulate an individual's health behaviour change needs).*
521 However, assessment is not a one-time pre-intervention task. *Children living with obesity should be*
522 *monitored and supported as they engage in weight-management efforts, and consideration of their*
523 *(changing) psychosocial and emotional needs should be part of the behaviour-change efforts, hence*
524 *seeking to increase the likelihood of achieving the desired behavioural outcome (e.g., weight*
525 *maintenance, healthier eating).*

526 It is important to note that this review aims to encourage those working in the field of
527 childhood obesity and nutrition to reconsider their intervention design and implementation when
528 working directly with children and families seeking to improve their diet behaviour or engage in
529 childhood obesity interventions. The review highlights various psychological and psychosocial
530 factors that may be a cause or consequence of living with childhood obesity, though this review is
531 not exhaustive and various other factors and mechanisms may be relevant. The review does not
532 consider the wider context of childhood obesity, such as the obesogenic environment⁽⁹⁹⁾, including
533 the environmental, economic, political and cultural factors that may also impact on the prevalence
534 and indeed management of childhood obesity.

535 In summary, to enhance the effectiveness of obesity interventions, *it is crucial to broaden*
536 *the focus and include psychology fully into the design of childhood obesity interventions⁽¹⁰⁰⁾ and*
537 *look beyond the physical behavioural outcomes as the only focus of the intervention.* Those
538 commissioning, designing and implementing childhood obesity interventions should therefore
539 consider a more holistic approach that, considers the psychological and emotional needs, and
540 incorporates the underlying mechanisms of action, which could lead to a more sustainable and
541 effective treatment for childhood obesity.

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546 Dr. Newson's presentation at the Nutrition Society Conference (July 2023). Subsequently, in August
547 2023, follow-up online conversations with five young people living with obesity included feedback
548 on the initial conference presentation, discussions about relevant research, and agreeing key points
549 for inclusion in this review. From their perspective the aim of this review was to encourage other
550 health professionals to understand why it is important to consider the psychological needs of
551 children and young people living with obesity.

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