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Title

Changes in parental feeding practices and preschoolers' food habits following a randomized controlled childhood obesity trial

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Abstract

Childhood obesity treatment involving parents is most effective during the preschool age. However, the mechanisms of change are not known. The present study reports on secondary outcomes (changes in parental feeding practices and child food habits) of early obesity treatment. The More and Less study is a randomized controlled trial conducted in Stockholm County, Sweden. Children with obesity (n=174, mean BMI SDS 3.0, mean age 5 years, 56% girls) and their parents (60% with foreign background, 40% with a university degree) were randomized to: 1) standard treatment focusing on lifestyle recommendations (ST), 2) a parent support program with boosters (PGB), and 3) a parent support program without boosters (PGNB). The Child Feeding Questionnaire (CFQ) was used to measure parental feeding practices. Child food habits were assessed with a Food Frequency Questionnaire (FFQ). We calculated the monthly changes in CFQ practices and FFQ items based on four measurements. We did not find any significant between-group differences in parental feeding practices and child food habits over time. However, general linear models showed that changes in certain feeding practices predicted changes in child food habits. When ST was compared to the parent support groups, some associations moved in opposite directions. For example, increasing maternal restriction predicted increased consumption of cookies/buns in PGNB ($b=2.3$, $p<0.05$) and decreased consumption of cookies/buns in ST ($b=-2.1$, $p<0.05$). This is the first study to examine the effect of parental feeding practices on child food habits and weight status after obesity treatment among preschoolers. We found no evidence that changes in feeding practices or changes in child food habits mediated child weight loss. Future studies should consider other intermediary processes related to general parenting practices and parent-child interactions.

Keywords: Parental feeding practices, Child feeding questionnaire, Randomized controlled trial, Child eating, Family-based treatment

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3 **1 Manuscript**
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5 **2 1. Introduction**
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7
8 3 Successful interventions for early childhood obesity treatment typically involve parents and
9
10 4 integrate support in parenting skills with information on a healthy lifestyle (Golan, Kaufman,
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12 5 & Shahar, 2006; Loveman, et al., 2015). These interventions seek to enhance the family
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14 6 environment and thereby support changes in child behaviors indirectly (parent-child
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16 7 interactions) and directly (child food intake and eating routines), with the aim of promoting
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18 8 changes in child weight status. Few studies, however, have examined parental and child
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20 9 behaviors as outcomes (Colquitt, et al., 2016; Duncanson, Shrewsbury, Collins, & Consortium,
21
22 10 2017; Loveman, et al., 2015). In addition, fathers have rarely been included in these studies
23
24 11 (Morgan, et al., 2017), despite the increasing involvement of fathers in cooking and feeding
25
26 12 (Neuman, Eli, & Nowicka, 2019). Thus, better insight into how family subsystems affect
27
28 13 behaviors that drive changes in child weight status may inform more effective and tailored
29
30 14 obesity interventions.
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33
34 15 In the present paper, we analyze secondary outcomes of the More and Less study (ML study),
35
36 16 a randomized controlled trial (RCT) assessing obesity interventions for preschool-age children
37
38 17 (Ek, et al., 2015). In the trial, the effect of three treatment conditions was evaluated: standard
39
40 18 treatment (ST), a parent support program with booster sessions (PGB), and a parent support
41
42 19 program without booster sessions (PGNB). The RCT's primary outcome results showed that
43
44 20 PGB was more effective in reducing child weight status over 12 months, compared to the other
45
46 21 conditions (Ek, et al., 2019). To understand what factors influenced the results, the present
47
48 22 paper evaluates changes in parental feeding practices and child food intake across the treatment
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50 23 groups over 12 months. The parent support program focuses on parenting practices to change
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52 24 child behaviors, therefore associations between changes in parental feeding practices and
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62 25 changes in child food intake are also examined through separate analyses for mother-child and
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64 26 father-child dyads.
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67 *1.1 Parental feeding practices and the Child Feeding Questionnaire* 68

69
70 28 Parental feeding practices are the specific strategies parents use during mealtime interactions
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72 29 (Blissett, 2011; Ventura & Birch, 2008), and have consistently been associated with child
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74 30 weight and eating behaviors (Birch, Fisher, & Davison, 2003; E. Jansen, Williams, Mallan,
75
76 31 Nicholson, & Daniels, 2018; Rollins, Savage, Fisher, & Birch, 2016). Parental feeding practices
77
78 32 are embedded in broader parenting styles that have also been associated with child weight status
79
80 33 (Collins, Duncanson, & Burrows, 2014; Hubbs-Tait, Kennedy, Page, Topham, & Harrist, 2008;
81
82 34 Niermann, Gerards, & Kremers, 2018; Sleddens, et al., 2014). The development of the Child
83
84 35 Feeding Questionnaire (CFQ) (Birch, et al., 2001) has facilitated a systematic examination of
85
86 36 controlling parental feeding practices among large samples from diverse contexts (Birch, et al.,
87
88 37 2003; Blissett & Bennett, 2013; Derks, et al., 2017; B. Y. Rollins, E. Loken, J. S. Savage, & L.
89
90 38 L. Birch, 2014; Wehrly, Bonilla, Perez, & Liew, 2014). In the CFQ, controlling parental feeding
91
92 39 practices are divided into three categories: restriction, pressure to eat and monitoring (Birch, et
93
94 40 al., 2001; Nowicka, Sorjonen, Pietrobelli, Flodmark, & Faith, 2014). Restriction and pressure
95
96 41 to eat represent two coercive forms of parental control during feeding interactions (Vaughn, et
97
98 42 al., 2016) which may override a child's innate signals of hunger and/or satiety (DiSantis,
99
100 43 Hodges, Johnson, & Fisher, 2011; Rollins, et al., 2016). On the other hand, monitoring is
101
102 44 conceptualized as a more favorable form of control whereby parents are aware of child food
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104 45 intake (Birch, et al., 2001; Gubbels, et al., 2011; Vaughn, et al., 2016).
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109 46 In most studies, restriction and pressure to eat have been associated with higher and lower child
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111 47 weight status, respectively; for monitoring, however, the findings have been less consistent
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113 48 (Shloim, Edelson, Martin, & Hetherington, 2015; Ventura & Birch, 2008). In addition, parental
114
115 49 feeding practices have been associated with child behaviors pertaining to food intake. Parental
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121 50 restriction of palatable and energy-dense foods relates to increased liking for and intake of these
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123 51 foods (Brandi Y. Rollins, Eric Loken, Jennifer S. Savage, & Leann L. Birch, 2014), while
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125 52 pressuring a child to eat particular foods relates to decreased liking for and intake of these foods,
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127
128 53 typically fruits and vegetables which are not readily accepted at younger ages (Galloway,
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130 54 Fiorito, Lee, & Birch, 2005; Galloway, Fiorito, Francis, & Birch, 2006). The majority of
131
132 55 studies, however, have been cross-sectional and the direction of the relationships is not clear,
133
134 56 although bi-directional relationships seem to be most plausible (Derks, et al., 2017; E. Jansen,
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136 57 et al., 2018; P. W. Jansen, et al., 2017).

138
139 58 Parental feeding practices should also be considered in light of child appetitive traits. From an
140
141 59 early age, children with obesity have higher responsiveness to external food cues and lower
142
143 60 responsiveness to their internal satiety cues. Therefore, they present distinctive behavioral
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145 61 profiles, which relate to increased food intake (Carnell & Wardle, 2008). Further, parents seem
146
147 62 more likely to adjust their feeding practices in response to child behaviors rather than to child
148
149 63 weight (e.g. pressure a child to eat if the child engages in picky eating behaviors, regardless of
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151 64 weight) (Ek, et al., 2016; E. Jansen, et al., 2018), which may exacerbate obesity-related child
152
153 65 behaviors (Rodgers, et al., 2013). Thus, treatment efforts would benefit from addressing and
154
155 66 evaluating the role of parental feeding practices in samples of young children with obesity. In
156
157 67 these evaluations, separate analyses for mothers' and fathers' feeding practices are needed since
158
159 68 previous research suggests that fathers employ more coercive practices than mothers do (Pratt,
160
161 69 Hoffmann, Taylor, & Musher-Eizenman, 2017).

162
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165 70 Feeding practices also relate to structural, socio-cultural, socioeconomic and other contextual
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167 71 factors (Blissett & Bennett, 2013; Cardel, et al., 2012; Nowicka, Sorjonen, et al., 2014; C. G.
168
169 72 Russell, et al., 2018). In our previous research, mothers born in a country other than Sweden
170
171 73 reported higher levels of controlling feeding practices (Nowicka, Sorjonen, et al., 2014;
172
173 74 Somaraki, et al., 2016). The present study includes a diverse sample in terms of parental foreign
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180 75 background, to overcome research limitations posed by studying homogeneous samples
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182 76 (Catherine Georgina Russell, et al., 2016).

185 77 ***1.2 Changes in parental feeding practices after obesity treatment***

188 78 A few studies reporting on childhood obesity interventions have assessed parental feeding
189
190 79 practices and found them to be modifiable (Burrows, Warren, & Collins, 2010; Epstein, Paluch,
191
192 80 Beecher, & Roemmich, 2008; Holland, et al., 2014; Mazzeo, et al., 2014; Stark, et al., 2014;
193
194 81 Steele, Jensen, Gayes, & Leibold, 2014). In particular, family-based treatment demonstrated
195
196 82 that modifications in parental feeding practices influence child dietary intake, which in turn
197
198 83 affects weight outcomes (Holland, et al., 2014). Previous research, however, has only included
199
200 84 families with older children; the one exception was a smaller study with children aged 2-5 years
201
202 85 old, which showed no changes in parental feeding practices after treatment (Stark, et al., 2014).

205 86 ***1.3 Child food intake in obesity treatment research***

208 87 In childhood obesity treatment, the child, the parents, and often all nuclear family members are
209
210 88 advised to decrease intake of energy dense foods and opt for healthier options (Altman &
211
212 89 Wilfley, 2015). Such changes in eating patterns are associated with reduced child weight status,
213
214 90 suggesting that parents play an important role in shaping healthy eating patterns and weight
215
216 91 trajectories (Best, et al., 2016; Hayes, et al., 2016; Robson, et al., 2019). Parent-focused
217
218 92 interventions specifically seek to enhance evidence-based parenting practices in order to shift
219
220 93 feeding dynamics towards healthier food intake. However, child food intake has not been
221
222 94 consistently assessed and reported in interventions for younger children (Duncanson, et al.,
223
224 95 2017).

228 96 ***1.4 Aim and hypotheses***

231 97 The present study reports on secondary outcomes of an RCT that evaluated a childhood obesity
232
233 98 intervention for families of preschoolers over a 12-month follow-up. Specifically, the study

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99 aims to investigate the role of parental feeding practices in child weight status and food intake
100 according to the conceptual model proposed in Fig. 1.

101 The objectives of this study are:

- 102 1. To investigate changes in parental feeding practices and child food intake after early
103 obesity treatment;
- 104 2. To examine the association between changes in parental feeding practices and changes
105 in child food intake after early obesity treatment;
- 106 3. To examine the moderating effect of parental feeding practices at baseline on changes
107 in child body mass index standard deviation scores (BMI SDS) after early obesity
108 treatment.

109 Our hypotheses are informed by the results of the ML study (Ek, et al., 2015; Ek, et al., 2019).
110 In ML, children whose parents participated in the PGB significantly decreased their BMI SDS
111 after 12 months by 0.54 (95% CI -0.77 to -0.30) compared to children in the PGNB and in the
112 ST groups (Ek, et al., 2019).

113 We hypothesize that parents enrolled in the PGB will experience a greater decrease in
114 restriction and pressure to eat, along with a greater increase in monitoring, compared to
115 parents enrolled in the other treatment conditions. Accordingly, we hypothesize that children
116 in the PGB will consume obesogenic foods less often over time and increase their
117 consumption frequency for healthier food options. In addition, we expect that changes in
118 parental feeding practices will be associated with changes in child food intake over the
119 follow-up period, in the PGB compared to the other groups. Moreover, we hypothesize that
120 baseline levels of parental feeding practices will moderate treatment effects on child weight
121 status over the 12-month follow-up, whereby receiving parenting training will most benefit

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122 parents with higher baseline levels of restriction/pressure to eat and lower levels of
123 monitoring. Regarding separate analyses for mother-child and father-child dyads, we expect
124 that they will yield similar results according to the hypotheses stated above. In addition, we
125 expect that changes in both mothers' and fathers' feeding practices will be associated with
126 changes in child food intake.

127 PLEASE INSERT FIGURE 1 HERE

128 **Figure 1.** A conceptual illustration of the expected interrelations between parental feeding
129 practices, child food intake and child weight status after early obesity treatment focusing on
130 parenting. Panel A (above). The hypothesized moderation effect of baseline feeding practices
131 on child weight status (primary treatment outcome). Panel B (below). The hypothesized
132 intermediary role of parental feeding practices and child food intake in treatment
133 effectiveness. Dashed arrows leading to the primary outcome of the RCT are not examined in
134 the present paper.

136 **2. Methods**

137 **2.1 Study design**

138 The ML is a parallel open label RCT (NCT01792531) designed to evaluate the effects of two
139 approaches (a parent support program with and without booster sessions and standard
140 treatment) to treat obesity in preschoolers. A description of the study procedure and treatment
141 groups has been published elsewhere (Ek, et al., 2015; Ek, et al., 2019), and a brief summary is
142 provided below. The ML study was approved by the ethics committee in Stockholm, Sweden
143 on November 16th 2011 (dnr: 2011/1329-31/4). All participating caregivers provided written
144 informed consent.

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357 145 **2.2 Participant recruitment**
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360 146 Families were eligible to participate based on the following criteria:
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363 147 The child:

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365 148 1) was 4 to 6 years old at baseline;
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368 149 2) was classified as having obesity according to international age- and sex-specific criteria
369

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371 150 (Cole, Bellizzi, Flegal, & Dietz, 2000; Cole & Lobstein, 2012);
372

373
374 151 3) did not have any known chronic or developmental conditions that could influence his/her
375
376 152 weight and height development;
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378
379 153 4) was not already in treatment for obesity.
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381 154 Additionally, parents' knowledge of Swedish needed to be sufficient to answer questionnaires
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383 155 and participate in treatment.
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386 156 Families were mainly recruited from 68 child health care centers (primary care). In addition,
387
388 157 outpatient pediatric clinics (secondary care) and school health care offices in Stockholm
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390 158 County, Sweden, contributed to recruitment.
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393 159 After baseline measures, families were assigned (1:1:2) to one of three treatment groups (PGB,
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395 160 PGNB, ST) using an electronic randomization program with permuted blocks. In the parent
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397 161 support program, families and research group members remained blinded to group allocation
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399 162 into booster and non-booster sessions until the ending of the parent group sessions. The study
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401 163 statistician maintained the randomization sequence. Data were collected between May 2012
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403 164 and October 2017.
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406 165 **2.3 Sample size**
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416 166 Power calculations were based on the primary outcome, child BMI SDS (Kleber, et al., 2009),
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418 167 adjusting for a dropout rate of 21% (Ek, et al., 2015; West, Sanders, Cleghorn, & Davies, 2010).
419
420 168 Seventy-five children were estimated to be needed in each of the treatment approaches (parent
421
422 169 support program and standard treatment) in order to identify a difference in BMI SDS between
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424
425 170 the groups at 12 months post-baseline.

426 427 171 ***2.4 Standard treatment***

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430 172 The ST group received the usual care offered in outpatient pediatric clinics, based on the action
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432 173 plan for childhood obesity in Stockholm County (SLL, 2016). Individual families were offered
433
434 174 5.5 visits on average over one year (Ek, et al., 2019). The treatment sessions focused on lifestyle
435
436 175 modifications with respect to eating and activity habits. During the first visit families met with
437
438 176 a pediatrician. In follow-up visits, families usually met with a pediatric nurse. If required, some
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440 177 families were also referred to a dietician, psychologist, physiotherapist or occupational
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442 178 therapist.

443 444 445 179 ***2.5 Parent support program (with and without booster sessions)***

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447
448 180 The ML parent support program includes 10 group sessions (1.5 hours/week); each session
449
450 181 integrates a parenting component along with a lifestyle component (Ek, et al., 2015). The
451
452 182 treatment focuses on strengthening skills that help parents support and sustain a healthy lifestyle
453
454 183 and respond to child behaviors in an effective way. The lifestyle content addresses healthy food
455
456 184 choices that each family can incorporate into daily practice. Through the program's focus on
457
458 185 parenting skills, parents are prompted to implement responsive feeding – characterized by low
459
460 186 levels of coercive control and high levels of structure – which has been associated with positive
461
462 187 weight outcomes (Rollins, et al., 2016). Either alone or with their partners, mothers were more
463
464 188 likely to attend the group sessions than fathers were (58% vs. 42%). All attendees were
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475 189 encouraged to share relevant information with their co-parent or co-caregiver. A participant
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477 190 manual facilitated this process.
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480 191 Following the parent support program, families randomized to booster sessions received
481
482 192 individual support through 30-minute phone calls from the research team every 4 to 6 weeks
483
484 193 for up to 12 months post-baseline. The booster sessions revolved around encouraging parents
485
486 194 to maintain healthy habits and empowering them to face additional challenges that might have
487
488 195 emerged. During these phone calls, booster session facilitators referenced the content of the
489
490 196 treatment program and the group sessions.
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493 197 ***2.6 Measurements***

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495
496 198 All measures were administered at baseline, 3, 6 and 12 months post-baseline. Both mothers
497
498 199 and fathers reported on their feeding practices, while one parent (mother or father) reported on
499
500 200 child food intake. Mothers and fathers were defined as caregivers who identified as the child's
501
502 201 biological parent and who reported, through a questionnaire, that they were female or male,
503
504 202 respectively. None of the children in the sample were adopted or in the sole care of caregivers
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506 203 other than their biological parents.
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511 512 205 ***2.6.1 Parental feeding practices***

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514
515 206 We used the CFQ to examine key obesity-related feeding practices employed by parents
516
517 207 (mothers and fathers) (Birch, et al., 2001; Nowicka, Sorjonen, et al., 2014). The CFQ consists
518
519 208 of 3 subscales - restriction, pressure to eat and monitoring (Shloim, et al., 2015; Ventura &
520
521 209 Birch, 2008). Restriction (Cronbach's alpha for mothers 0.7, for fathers 0.8) consists of 6 items
522
523 210 (e.g. "I have to be sure that my child does not eat too many high-fat foods"), and pressure to eat
524
525 211 (Cronbach's alpha for mothers 0.5; for fathers 0.5) consists of 4 items (e.g. "My child should
526
527 212 always eat all of the food on her plate"), with responses ranging from 1 (disagree) to 5 (agree).
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213 Monitoring (Cronbach’s alpha for mothers 0.8; for fathers 0.9) consists of 3 items (e.g. “How
214 much do you keep track of the sweets (candy, ice-cream cake, pies, pastries) that your child
215 eats?”) with responses ranging from 1 (never) to 5 (always). The “reward items” for restriction
216 were excluded in the Swedish sample after a validation of the questionnaire (Nowicka,
217 Sorjonen, et al., 2014). The total score for each feeding practice is the mean score of its
218 component items. Higher mean scores indicate greater endorsement of the respective practice.

219 **2.6.2 Child food intake**

220 A Food Frequency Questionnaire (FFQ) assessed child food intake relevant to obesity treatment
221 (Ek, et al., 2015). The FFQ was part of a more extensive questionnaire about background
222 characteristics of the child (e.g. child’s birth date, siblings) along with current information about
223 the child’s health (e.g. health conditions and lifestyle). At each time point, one parent reported
224 on the child’s usual food intake. The FFQ assessed the consumption frequency of 10 food items
225 (fresh fruits, vegetables, pizza/hamburger, fish, ice-cream, cookies/buns, soft drinks, juice,
226 sweets & chocolate, chips & snacks), with the response categories ranging from once per month
227 or less to four times per day or more (13 response options in total). Frequency equivalents were
228 calculated for monthly consumption. The food items listed in the FFQ have been used in several
229 international studies (Byrne, et al., 2019; Golley, et al., 2017). In the Swedish context, the items
230 have been included in a national survey administered by the National Food Agency
231 (Livsmedelsverket) to monitor population trends (Enghardt Barbieri, Pearson, & Becker, 2006).
232 In addition, the items have been validated using food diaries in a nation-wide obesity prevention
233 study in young children (Doring, et al., 2014).

234 **2.6.3 Child BMI SDS**

235 Child height and weight were measured by trained health care professionals. Height was
236 measured to the nearest 0.1 cm using a fixed stadiometer and weight was measured to the

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593 237 nearest 0.1 kg in underwear. BMI was calculated based on weight and height. The primary
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595 238 outcome of the RCT, BMI SDS, was computed based on age- and sex-specific reference data
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597 239 (Cole & Lobstein, 2012).
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600 240 **2.7 Statistical analysis**

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603 241 Background characteristics were compared across the three treatment groups (PGB, PGNB, ST)
604
605 242 at baseline using one-way ANOVA (for continuous variables) and chi-squared test (for
606
607 243 categorical variables). Moreover, baseline characteristics were compared across mothers and
608
609 244 fathers using paired samples t-test (for continuous variables) and McNemar's test (for
610
611 245 categorical variables). Mean change per month (for maternal/paternal feeding practices -
612
613 246 restriction, pressure to eat and monitoring, child food intake and child BMI SDS) was computed
614
615 247 for each individual child/parent (Pfister, Schwarz, Carson, & Jancyzk, 2013). In linear
616
617 248 regression models, all measurements of each variable (dependent variable) for the individual
618
619 249 child/parent were regressed on an independent time variable (0, 3, 6, and 12 months). The
620
621 250 extracted mean change per month in each variable was utilized to carry out standard
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623 251 significance tests and statistical procedures. Mean changes were not calculated for individuals
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625 252 who had missing data at two measurement points, and these individuals are not included in the
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627 253 analyses. Moreover, individuals who had invariable measurements at all measurements points
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629 254 were assigned the value zero and were included in the analytical sample.
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633 255 One-way ANOVAs were used to compare the mean change of maternal and paternal feeding
634
635 256 practices across treatment groups (objective 1), and one-sample t-tests were used to compare
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637 257 the mean change within each treatment group against zero change. Moreover, paired samples
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639 258 t-tests were employed to compare the mean change between maternal and paternal feeding
640
641 259 practices. General linear models were used to explore the effect of change in parental feeding
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643 260 practices (independent variable) on change in child food intake (dependent variable) (objective
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645 261 2). The models included a 'treatment group x change in feeding practices' interaction term to
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652 262 evaluate differences between groups. The analyses were separate for mother-child and father-
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654 263 child dyads. When the interaction was found significant, we proceeded to explore the
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656 264 associations of changes in parental feeding practices with changes in child eating patterns in
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658 265 each treatment group separately. If no significant interaction was found, the associations were
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660
661 266 explored using the total sample.

662
663 267 Moreover, the moderating effect (objective 3) of baseline feeding practices on changes in child
664
665 268 BMI SDS was examined using general linear models. Change in BMI SDS was the dependent
666
667
668 269 variable and we added the interaction term ‘treatment group x baseline feeding practices’. The
669
670 270 analyses were separate for mother-child and father-child dyads.

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672
673 271 The significance levels for all analyses were set at 0.05. The software package IBM SPSS
674
675 272 Statistics 24 was used for all statistical analyses.

676 677 273 *2.7.1 Missing data*

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680 274 We used an intention-to-treat (ITT) approach, as far as missing data allowed, and listwise
681
682 275 deletion was applied. Thus, we analyzed the available data without imputing the unknown
683
684 276 values.

685 686 687 277 **3. Results**

688
689 278 No significant differences in baseline characteristics were found across the treatment conditions
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691 279 (Table 1). On average, children were 5.2 years old and had a BMI SDS of 3.0 at baseline. Their
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693 280 mothers and fathers reported higher restriction (3.8 and 3.5) and monitoring (4.0 and 3.8)
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695 281 compared to pressure to eat (2.1 and 2.3) at baseline, respectively. As compared to mothers,
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697 282 fathers reported lower levels of restriction (3.5 vs. 3.8) and monitoring (3.8 vs. 4.0). However,
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699 283 at baseline neither maternal nor paternal feeding practices differed across treatment groups.
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701 284 Foreign background and education level did not differ between mothers and fathers.

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705 285 Table 1. Characteristics of the study sample at baseline

| | N | Total sample | Parent program | | Standard treatment |
|--------------------------|-----|---------------------|-----------------------|--------------------------|---------------------|
| | | N=174 | With boosters n=44 | Without boosters n=43 | n=87 |
| | | no.(%) or mean (SD) | no.(%) or mean (SD) | | no.(%) or mean (SD) |
| Child | | | | | |
| Girl | 174 | 98 (56.3) | 19 (43.2) | 23 (53.5) | 56 (64.4) |
| Living with both parents | 143 | 113 (79) | 25 (78.1) | 31 (81.6) | 57 (78.1) |
| First born | 147 | 72 (49) | 15 (41.7) | 21 (51.2) | 36 (51.4) |
| Age at baseline | 174 | 5.2 (0.78) | 5.2 (0.83) | 5.2 (0.86) | 5.3 (0.71) |
| BMI SDS at baseline | 174 | 2.97 (0.61) | 2.99 (0.55) | 3.01 (0.69) | 2.91 (0.59) |
| Mother | | | | | |
| Age | 139 | 36.6 (5.5) | 38 (5.1) | 36 (5.4) | 36 (5.7) |
| BMI | 141 | 28.1 (5.7) | 28.2 (6) | 29.1 (6.5) | 27.6 (5.1) |
| Foreign background | 145 | 89 (61.4) | 21 (63.6) | 21 (56.8) | 47 (62.7) |
| University degree | 143 | 58 (40.6) | 14 (42.4) | 15 (41.7) | 29 (39.2) |
| Father | | | | | |
| Age | 124 | 39.8 (7.1) | 43 (7.9) | 39 (7.4) | 39 (6.3) |
| BMI | 126 | 29.4 (4.4) | 29.1 (4.20) | 30.02 (4.59) | 29.34 (4.46) |
| Foreign background | 130 | 75 (57.7) | 17 (54.8) | 21 (63.6) | 37 (56.1) |
| University degree | 128 | 49 (38.3) | 11 (36.7) | 12 (37.5) | 26 (39.4) |

3.1 Changes in parental feeding practices

Table 2 shows the mean changes in mothers' and fathers' feeding practices over time. We found no difference between or within treatment groups. Moreover, no significant differences were found between mothers and fathers in mean change in feeding practices in the total sample.

Table 2. Baseline parental feeding practices and mean monthly changes after a randomized controlled childhood obesity trial

| CFQ Child Feeding Questionnaire | n | Parent group with boosters (PGB) | | Parent group without booster (PGBN) | | Standard treatment (ST) | | p-value* |
|---|-----|----------------------------------|----------------------------------|-------------------------------------|----------------------------------|-------------------------|----------------------------------|----------|
| | | Baseline [‡] | Mean monthly change [‡] | Baseline [‡] | Mean monthly change [‡] | Baseline [‡] | Mean monthly change [‡] | |
| <i>Maternal Feeding Practices^a</i> | | | | | | | | |
| Restriction | 123 | 3.8 (0.9) | 0.02 | 3.8 (0.8) | 0.01 | 3.8 (0.7) | 0.01 | 0.69 |
| Pressure to eat | 121 | 2.2 (0.8) | -0.01 | 2.0 (0.9) | -0.03 | 2.0 (0.9) | -0.03 | 0.61 |
| Monitoring | 126 | 4.0 (0.6) | 0.02 | 4.0 (0.8) | 0.01 | 4.1 (0.9) | 0.03 | 0.77 |
| <i>Paternal Feeding Practices^a</i> | | | | | | | | |
| Restriction | 110 | 3.5 (0.8) | 0.01 | 3.4 (0.8) | -0.003 | 3.5 (0.9) | 0.01 | 0.80 |
| Pressure to eat | 113 | 2.2 (0.8) | 0.01 | 2.4 (0.8) | 0.01 | 2.3 (0.8) | -0.02 | 0.53 |
| Monitoring | 112 | 3.7 (0.6) | 0.02 | 3.5 (1.0) | 0.02 | 3.9 (0.8) | -0.002 | 0.14 |

[‡] Mean monthly changes were computed for each parent in the study based on measurements at all four time points (baseline, 3, 6 and 12 months)

*p-values for comparisons of changes in feeding practices across treatment groups; one-way ANOVA

[‡] maternal/paternal feeding practices at baseline did not differ across treatment groups (p>0.05); one-way ANOVA

^a no significant within-group mean monthly changes (p>0.05); one sample t-test with test value set to zero

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3.2 Changes in child eating patterns

Changes in reported intake of food items did not differ between the children in the different treatment conditions (Table 3). Some within-group changes, however, were found to be significant. The average monthly consumption of cookies/buns decreased over time among children in two treatment groups (PGBN: by 0.2, $p < 0.05$, and ST: by 0.2, $p < 0.05$). Moreover, children in ST decreased their reported consumption of sweets and chocolate (by 0.2 per month, $p < 0.05$).

Table 3. Baseline child food intake and monthly changes after a randomized controlled childhood obesity trial

| FFQ Food Frequency Questionnaire (per month) | n | Parent group with boosters (PGB) | | Parent group without booster (PGBN) | | Standard treatment (ST) | | p-value * |
|--|-----|----------------------------------|----------------------------------|-------------------------------------|----------------------------------|-------------------------|----------------------------------|-----------|
| | | Baseline [‡] | Mean monthly change [‡] | Baseline [‡] | Mean monthly change [‡] | Baseline [‡] | Mean monthly change [‡] | |
| Fruit | 128 | 45 (34) | -0.5 | 57 (24) | -1.4 | 48 (28) | 0.004 | 0.40 |
| Vegetables | 128 | 40 (29) | -0.2 | 49 (26) | -0.3 | 50 (30) | -0.3 | 0.97 |
| Pizza & hamburgers | 128 | 2.1 (1.6) | 0.02 | 2.4 (1.6) | -0.05 | 2.1 (1.5) | -0.01 | 0.38 |
| Fish | 129 | 6.2 (4.3) | 0.3 | 8.6 (9.8) | -0.3 | 7.7 (10) | -0.2 | 0.15 |
| Ice-cream | 129 | 5 (7) | -0.1 | 3.6 (2.3) | 0.1 | 4.1 (3.9) | -0.1 | 0.20 |
| Cookies/buns | 128 | 4.2 (3.1) | -0.1 | 5.5 (3.5) | -0.2 ^a | 5.1 (5.6) | -0.2 ^a | 0.78 |
| Soft drinks | 127 | 5.8 (5.1) | -0.2 | 4.3 (3.5) | -0.03 | 6.7 (12.5) | -0.5 | 0.32 |
| Juice | 126 | 11.6 (22.3) | -0.3 | 8.4 (9.9) | -0.2 | 7.7 (10.7) | -0.2 | 0.93 |
| Sweets & chocolate | 128 | 4.5 (2.5) | -0.05 | 4.7 (1.8) | -0.01 | 5.3 (5.2) | -0.2 ^a | 0.10 |
| Snacks | 128 | 3.5 (2.2) | -0.02 | 3.6 (3.1) | -0.1 | 3.4 (4) | -0.1 | 0.80 |

[‡] Mean monthly changes were computed for each parent in the study based on measurements at all four time points (baseline, 3, 6 and 12 months)

*p-values for between-group comparisons of mean changes in child food intake; one-way ANOVA

[‡] child food intake at baseline did not differ across treatment groups ($p > 0.05$); one-way ANOVA

^a significant within-group mean monthly changes ($p < 0.05$); one sample t-test with test value set to zero

307 **3.3 Associations between changes in parental feeding practices and changes in child eating**
 308 **patterns over 12 months of follow-up**

309 For the total sample, increased monthly consumption of cookies/buns was associated with
 310 increasing maternal pressure to eat ($b=1.1, p<0.05$) and decreased monthly consumption of
 311 sweets and chocolate was associated with increasing maternal monitoring ($b=-1.4, p<0.05$). The
 312 associations between changes in parental feeding practices and changes in the monthly
 313 consumption of certain foods diverged between treatment groups (Table 4). In ST, mothers’
 314 and fathers’ increased restriction was associated with a decrease in child intake of pizza and
 315 hamburgers per month ($b=-1.4, p<0.001$ and $b=-1.1, p<0.001$, respectively); the same pattern
 316 was shown for mothers’ increased monitoring ($b=-1.1, p<0.001$). By contrast, increased levels
 317 of mothers’ restriction in PGNB were associated with increased monthly intake of pizza and
 318 hamburgers ($b=0.7, p<0.05$), and cookies/buns ($b=2.3, p<0.05$). Increased levels of restriction
 319 among both mothers and fathers in ST were associated with a decrease in the child’s monthly
 320 intake of ice-cream ($b=-3.6, p<0.001$ and $b=-3.3, p<0.001$, respectively).
 321 Moreover, increasing maternal pressure to eat was associated with increased ice-cream
 322 consumption in PGB ($b=1.3, p<0.05$) and decreased ice-cream consumption in PGNB ($b=-3.1,$
 323 $p<0.001$). Interestingly, increased maternal restriction and pressure to eat were associated with
 324 increased monthly consumption of fruits and vegetables in PGNB only.

325 Table 4. Associations between mean changes in parental feeding practices with mean changes
 326 in child food intake

| | MOTHERS | | | FATHERS | | |
|---------------------------------|-------------------------------------|--------------------------------------|------------------|-------------------------------------|--------------------|----------------------|
| | Restriction ‡ | Pressure to eat ‡ | Monitoring‡ | Restriction ‡ | Pressure to eat ‡ | Monitoring ‡ |
| Fruits ‡ | × PGNB: $b=20.4^*$ | × PGNB: $b=25.1^*$ | ns | ns | ns | ns |
| Vegetables ‡ | ns | × PGNB: $b=12.1^*$ | ns | ns | ns | ns |
| Pizza & hamburgers ‡ | × PGNB: $b=0.7^*$ ST: $b=-1.4^*$ | $b=0.5^*$ | × ST: $b=-1.1^*$ | × PGNB: $b=0.6^*$ ST: $b=-1.1^*$ | × PGNB: $b=-0.4^*$ | ns |
| Fish ‡ | ns | ns | ns | n.s | ns | × PGNB: $b=6.7^*$ |
| Icecream ‡ | × ST: $b=-3.6^*$ | × PGB: $b=1.3^*$ PGNB: $b=-3.1^*$ | × ST: $b=-1.8^*$ | × ST: $b=-3.3^*$ | ns | ns |

| | | | | | | |
|---------------------------------|-------------------------------|----------------|---------|----|----|----|
| Cookies/buns ‡ | × PGNB: b=2.3* ST: b=-2.1* | b=1.1* | ns | ns | ns | ns |
| Sweet drink ‡ | ns | ns | ns | ns | ns | ns |
| Juice ‡ | ns | ns | ns | ns | ns | ns |
| Sweets & chocolate ‡ | ns | ns | b=-1.4* | ns | ns | ns |
| Snacks ‡ | ns | × PGNB: b=2.1* | ns | ns | ns | ns |

PGB: Parent group with boosters; PGNB: Parent group without boosters; ST: Standard treatment

‡ Mean monthly changes were computed based on all four measurements (baseline, 3, 6 and 12 months) for each family in the study

× Food items for which divergent associations were found between treatment groups (significant interaction between treatment group and changes in feeding practices); otherwise associations were examined in the total sample

*p<0.05; ns: not statistically significant, null association

Mean monthly change for individuals with the same measurements over time were assigned the value zero.

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328 3.4 Moderating effects of parental feeding practices on changes in child BMI SDS

329 Changes in parental feeding practices did not differ across treatment groups. Further, parental
 330 feeding practices at baseline did not moderate the treatment effect on changes in child BMI
 331 SDS between treatment groups (Table 5).

332 Table 5. Effects of baseline levels of parental feeding practices on changes in child BMI SDS

| | Parental feeding practices at baseline | MOTHERS | | | FATHERS | | |
|------|--|---------|-------------------------------------|-------------------|---------|-------------------------------------|-------------------|
| | | n | Child BMI SDS mean monthly change ‡ | p-value | n | Child BMI SDS mean monthly change ‡ | p-value |
| PGB | Restriction | 25 | 0.013 | 0.11 ^a | 23 | 0.006 | 0.50 ^a |
| | Pressure to eat | 24 | 0.004 | 0.64 ^a | 25 | 0.009 | 0.28 ^a |
| | Monitoring | 25 | 0.020 | 0.07 ^a | 25 | 0.007 | 0.53 ^a |
| PGNB | Restriction | 31 | -0.002 (0.013-0.015) [*] | 0.17 ^b | 27 | -0.007 (0.006-0.013) [*] | 0.29 ^b |
| | Pressure to eat | 31 | 0.01 (0.004+0.006) [*] | 0.60 ^b | 28 | 0.003 (0.009-0.006) [*] | 0.62 ^b |
| | Monitoring | 32 | 0.001 (0.020-0.019) [*] | 0.17 ^b | 28 | -0.002 (0.007-0.009) [*] | 0.50 ^b |
| ST | Restriction | 57 | -0.01 (0.013-0.022) [*] | 0.03 ^b | 54 | 0.001 (0.006-0.005) [*] | 0.62 ^b |
| | Pressure to eat | 56 | -0.01 (0.004-0.014) [*] | 0.18 ^b | 54 | -0.001 (0.009-0.010) [*] | 0.33 ^b |
| | Monitoring | 59 | 0.003 (0.020-0.017) [*] | 0.16 ^b | 53 | 0.005 (0.007-0.003) [*] | 0.84 ^b |

‡ Mean monthly changes were computed for each parent in the study based on measurements at all four time points (baseline, 3, 6 and 12 months)

PGB: Parent group with boosters; PGNB: Parent group without boosters; ST: Standard

Reference group: Parent group with boosters (PGB)

^asignificance level for the coefficient in the reference group

^{*} the coefficient in the parent group with boosters and standard treatment as the output of the function in parenthesis

^bsignificance level for the difference in coefficients compared to the reference group

Treatment group interactions with mothers' feeding practices at baseline: 1) restriction ($p=0.08$), 2) pressure to eat ($p=0.07$), 3) monitoring ($p=0.32$)

Treatment group interactions with fathers' feeding practices at baseline: 1) restriction ($p=0.57$), 2) pressure to eat ($p=0.61$), 3) monitoring ($p=0.70$)

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948 335 **4. Discussion**
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951 336 This is among the few studies to examine changes in parental feeding practices and changes in
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953 337 child food intake in the context of obesity treatment for preschoolers. We analyzed secondary
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955 338 outcomes from the ML study, in which a parent support program with boosters (PGB) was
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957 339 shown to be more effective than the program without boosters (PGNB) as well as standard
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959 340 treatment (ST) in decreasing child weight status. Contrary to our hypotheses, we found that
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961 341 PGB was no more effective in changing parental feeding practices or child food intake than
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963 342 PGNB or ST. Associations between changes in parental feeding practices and changes in child
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965 343 food intake were identified mainly in PGNB and ST. Moreover, we did not find that different
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967 344 levels of parental feeding practices at baseline moderated treatment effectiveness.

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971 345 We conducted this study to understand whether the greater decrease in child weight status in
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973 346 the PGB group (Ek, et al., 2019) could be explained by changes in parental feeding practices.
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975 347 To our disappointment, our hypothesis was not confirmed. Previous studies like ours have
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977 348 provided mixed evidence (Okely, et al., 2010; Stark, et al., 2014). A pilot US study comparing
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979 349 family-based behavioral obesity treatment with home visits and pediatrician counseling found
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981 350 greater decrease in child weight after family-based behavioral treatment, although changes in
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983 351 parental feeding practices did not differ between the groups (Stark, et al., 2014). However, in
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985 352 the Australian study HICKUPS, participants in a parent group intervention arm with a focus on
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987 353 diet decreased their restriction more than parents whose intervention did not include the diet
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989 354 component; the former group was also more successful in decreasing child weight status
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991 355 (Burrows, et al., 2010; Okely, et al., 2010). The differences between these groups regarding
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993 356 feeding practices were driven by changes in the two reward items of the CFQ restriction scale
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995 357 (Burrows, et al., 2010). These items describe counterproductive parental behaviors related to
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997 358 offering food in exchange for good behavior (Vaughn, et al., 2016). In Swedish society, using
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1006 359 food to reward children is generally considered inappropriate, and in the Swedish validation of
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1008 360 the CFQ the reward items had to be excluded due to social desirability issues as seen by high
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1010 361 ceiling effect (Nowicka, Sorjonen, et al., 2014). Hence, although the CFQ has been widely used
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1013 362 by researchers to measure parental feeding practices in the past two decades (Shloim, et al.,
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1015 363 2015; Ventura & Birch, 2008), methodological issues related to the feeding practices the CFQ
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1017 364 assesses might explain the lack of group differences in our study. In a recent summary of
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1019 365 measurements of parental feeding, Vaughn, et al. (2016) list a wide range of parental feeding
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1021 366 strategies involving structure and control. Not all the parental strategies listed are represented
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1023 367 in the CFQ, and it is possible that changes in parental feeding practices that we did not measure
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1025 368 could explain our results.

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1028 369 The greater reduction in child weight status in PGB was also not explained by changes in
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1030 370 reported child food intake. In fact, children within PGNB and ST reportedly reduced their
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1032 371 consumption frequency of cookies and buns by half compared to baseline. Although assessment
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1034 372 of child food intake has not been prioritized in trials for obesity treatment (Duncanson, et al.,
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1036 373 2017), previous research has demonstrated a greater decrease in calorie-dense foods and caloric
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1038 374 intake, and a greater increase in dietary quality after intensive family-based treatment,
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1040 375 compared to counseling (Robson, et al., 2019). As the authors note, this change in eating
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1042 376 patterns also mirrors a greater decrease in child weight status in family-based treatment
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1044 377 (Robson, et al., 2019; Stark, et al., 2018), such that a lower energy intake may explain the
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1046 378 treatment effect (Kuhl, et al., 2014). In the present study, we found that child food intake
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1048 379 relevant to obesity treatment was within recommended levels in all groups already at baseline.
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1050 380 Thus, other aspects of food intake, such as portion sizes and energy intake, may have changed
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1052 381 during the intervention, which might explain the greater child weight loss in PGB. However,
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1054 382 more time-consuming methods, such as 24 h-recalls or food recall diaries, would have been
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1056 383 required to extract this information. We chose not to use them, as it would have resulted in
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384 greater participant burden. Likewise, we did not measure physical activity using objective
385 measurements such as accelerometers, and therefore could not assess if children’s physical
386 activity affected their energy balance.

387 We found that certain feeding practices were associated with child food intake. Increased
388 parental monitoring and restriction were associated with decreased consumption of energy-
389 dense foods in the total sample and ST. Although a reduction in energy-dense foods can be
390 expected with increased monitoring (Haszard, Skidmore, Williams, & Taylor, 2015; Rollins, et
391 al., 2016), it is a surprising finding considering the coercive nature of restriction, which previous
392 research has suggested might be counterproductive in relation to child eating behaviors (Fisher
393 & Birch, 1999; Rollins, et al., 2016). The similar associations for increased monitoring and
394 restriction may indicate that parents who reported restriction and parents who reported
395 monitoring were referring to similar kinds of control. Recent studies on feeding practices have
396 focused on disentangling the effects of overt control (child can detect parental control, e.g.
397 “How often are you firm about what your child should eat”) and covert control (child cannot
398 detect parental control, e.g. “Avoid buying sweets and crisps and bringing them into the
399 house?”) (Boots, Tiggemann, & Corsini, 2018; Nowicka, Flodmark, Hales, & Faith, 2014;
400 Ogden, Reynolds, & Smith, 2006). Whereas overt control may lead to unfavorable outcomes
401 over time, covert control is associated with more favorable weight and food intake outcomes
402 (Ogden, et al., 2006; Rodenburg, Kremers, Oenema, & van de Mheen, 2014), such that a more
403 nuanced understanding of parental restriction is needed (Vaughn, et al., 2016). The CFQ items
404 assessing restriction, however, may not make the distinction clear. Of note, a Swedish study of
405 nearly 900 mothers of preschoolers (Nowicka, Sorjonen, et al., 2014) showed that covert control
406 was moderately correlated with restriction (as measured through the CFQ). This shows that, in
407 Sweden, parents may interpret the CFQ restriction items as capturing covert controlling
408 behaviors related to structure and limit setting (Rollins, et al., 2016). Taken together, these

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409 findings highlight the challenges for operationalizing relevant constructs in parental feeding
410 research. The field has accumulated a theory-based pool of items that are developmentally
411 appropriate and easy to administer; however, novel ways to analyze existing data that account
412 for certain limitations may be needed. Item Response Theory (IRT) might be one alternative
413 which can facilitate analyses of empirical data while refining our existing conceptualization of
414 feeding practices so that they can be better operationalized (Gordon, 2015).

415 Despite such challenges, the different patterns of associations across treatment groups provide
416 insights into how parent-reported measures may change through different treatment approaches.
417 This is highlighted by the contrasting patterns of associations of increased restriction in PGNB
418 (increased consumption of pizza and hamburgers) and ST (decreased consumption of pizza and
419 hamburgers). The findings for ST align with a proposed model by which parental restriction
420 and monitoring of obesogenic foods relate to children's decreased consumption of these foods.
421 Because ST was less effective in improving child weight status, such associations may only
422 reflect increased knowledge on matters of nutrition and socially desirable responses,
423 considering the focus of ST on lifestyle modification and the provision of information about
424 *what* would be healthy/unhealthy to consume/not consume.

425 The associations for PGNB may reflect *how* parent-child dynamics shift after a parenting
426 program not solely focused on food and nutrition. In PGNB, increased restriction and pressure
427 to eat were associated with both increased consumption of healthy foods (fruits and vegetables)
428 and increased consumption of energy-dense foods (pizza and hamburgers and cookies and
429 buns). Parents who attended the program (without receiving booster sessions) may have become
430 more attuned to what their children ate (child food intake), adjusting their feeding practices
431 accordingly. As children grow older they tend to become more food responsive, and thereby
432 increase their obesogenic food intake. At the same time, children appear to become pickier with
433 food, possibly following a normal developmental trajectory. It is possible that in PGNB, parents

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434 reporting increasing restriction (or monitoring) along with increasing pressure to eat (which
435 may focus on ‘healthier’ food items, like vegetables) were responding to developmental
436 changes in children’s appetites (Ashcroft, Semmler, Carnell, van Jaarsveld, & Wardle, 2008;
437 Ek, et al., 2016). Data from the ML study indicated that, following the parenting program,
438 children with high levels of picky eating at baseline reduced their weight status over 12 months
439 to a lower degree than non-picky eaters (Sandvik, et al., 2019). Thus, introducing an assessment
440 of child characteristics, such as appetite traits, at baseline, might help to tailor treatment to
441 families’ needs. Taken together, the findings suggest that tailored treatment approaches may be
442 more suitable to address high consumption of certain energy-dense foods and/or the low
443 consumption of healthier foods. These findings are unexpected in light of the null associations
444 found in PGB, which is contrary to our hypotheses. Greater child weight loss in this group
445 cannot be explained by the associations between changes in parental feeding practices and
446 changes in child food intake presented in this paper. Such null findings in PGB reflect that
447 parental feeding practices, child weight status, and child food intake were not correlated at the
448 different time points (data not shown). It is possible that general parenting strategies, which
449 reflect the sustained focus on general parenting in PGB, and/or aspects of dietary intake not
450 measured in the study, e.g. portion sizes, may explain the effectiveness of the PGB.
451 Alternatively, parents in PGB who were actively involved for the entire follow-up period
452 became increasingly aware of their parenting practices and their child’s behavior, which may
453 have resulted in null associations between those over time.

454 Regarding the third study objective, our hypothesis was not confirmed and parental feeding
455 practices at baseline did not influence the effect of treatment on child weight status in either
456 mother-child or father-child dyads. In contrast, a study by Epstein, et al. (2008) found that
457 higher restriction at baseline predicted more favorable child weight outcomes for the treatment
458 group that focused on replacing energy-dense foods with healthier alternatives, compared to

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459 treatment that only focused on reducing energy-dense foods. This may be because parents who
460 exerted more control over child feeding at baseline continued to apply the same practices during
461 treatment. As a result, they were able to implement positive changes in child food intake, as
462 directed by the intervention, to influence child weight status. While the intervention described
463 by Epstein et al. (2008) exclusively focused on dietary changes without addressing parenting,
464 in the ML study, we have focused on evidence-based parenting practices, such as how to use
465 effective limit setting strategies and how to handle a power struggle with one’s child. Since
466 parental feeding practices did not differentially change over time across treatment groups, we
467 could not provide evidence that they mediated treatment effects. However, the children’s weight
468 status in the ML study may have been influenced by how general parenting strategies, including
469 parental feeding practices, changed over time (mediating effect) rather than by baseline levels
470 of parental feeding practices (moderating effect).

471 **4.1 Future studies**

472 Although PGB was more successful in decreasing child weight status (Ek, et al., 2019), in the
473 present study we found that changes in feeding practices did not differentially predict changes
474 in child food intake in PGB. Examining potential changes in more general parenting skills may
475 shed light on the greater decreases in child weight in this group. Because feeding practices have
476 considerable stability over time, general parenting might not influence parental feeding
477 practices in a measurable way (Duncanson, Burrows, & Collins, 2016; Powell, Farrow, Meyer,
478 & Haycraft, 2018), and might instead moderate the effects of feeding practices on child eating
479 patterns (Rodenburg, Kremers, Oenema, & van de Mheen, 2012; Sleddens, et al., 2014). Thus,
480 we believe that factors related to co-parenting and the combined effects of maternal and paternal
481 feeding practices (Pratt, et al., 2017; Tan, Domoff, Pesch, Lumeng, & Miller, 2019), as the child
482 perceives them, warrant further investigation. In the ML study, we developed and validated an
483 instrument to assess parenting practices and skills (unpublished data), which has the potential

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1301 484 to provide clearer answers on how the intervention worked. Our group will address this in a
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1303 485 future analysis.

1306 486 ***4.2 Strengths and limitations***

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1309 487 The main strength in our study is its diverse sample (Foster, Farragher, Parker, & Sosa, 2015).
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1311 488 Sixty percent of mothers and fathers were of non-Swedish background; this allows for higher
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1313 489 generalizability of the study across migrant groups, and better reflects demographic changes in
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1315 490 Sweden and in Europe more widely. Another strength of the study is the prior validation of the
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1317 491 CFQ in Sweden (Nowicka, Sorjonen, et al., 2014). In addition, we included a FFQ to assess
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1319 492 child food habits, which are rarely evaluated in obesity interventions (Duncanson, et al., 2017).
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1321 493 Placing equal focus on both mothers and fathers is also a strength. Previous research has focused
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1323 494 on maternal feeding practices and not much is known about the effect of paternal feeding
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1325 495 practices (Khandpur, Blaine, Fisher, & Davison, 2014; Morgan, et al., 2017). In the changing
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1327 496 family environment, both parents/caregivers and members of the extended family need to be
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1329 497 addressed (Eli, Howell, Fisher, & Nowicka, 2016; Niermann, et al., 2018). Our analysis, which
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1331 498 includes mother-child and father-child dyads, is an important step in acknowledging
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1333 499 subsystems within the family. Fathers along with mothers were involved in the parenting
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1335 500 program, although attendance varied. This may explain why mothers responded to the
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1337 501 questionnaires to a greater degree. No data on which caregivers attended ST are available.

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1341 502 The main limitation of the analysis is that power was calculated for the primary outcome of the
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1343 503 RCT, change in child BMI SDS, and not for parental feeding practices (Ek, et al., 2015).
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1345 504 Another limitation is missing data, which was more pronounced in fathers, for whom 61 and
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1347 505 89 questionnaires (35% and 51% of total sample) were missing at baseline and at 12 months
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1349 506 post-baseline, respectively. Consequently, analyses for mother-child dyads are based on a larger
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1351 507 sample, which may explain why some associations were found for mothers but not fathers. An
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1353 508 alternative explanation is that mothers predominantly filled out the child background
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questionnaire, which included the FFQ. Mothers also assumed greater responsibility for child eating/drinking. Hence, the observed associations may reflect maternal perceptions of parent-child dynamics in feeding. Moreover, mothers and fathers with a foreign background and no university degree were twice more likely not to respond to the questionnaires. However, the rate of missing data did not differ across treatment groups. We used a listwise approach, which has further reduced statistical power. Moreover, questionnaire data were self-reported and thus social desirability bias cannot be ruled out (Farrow, Blissett, & Haycraft, 2011). Low reliability for maternal/paternal pressure to eat presents additional methodological limitations, which may relate to the non-specificity of food items in the questions about pressure to eat in the CFQ.

4.3 Conclusion

This is among the few studies to examine the effect of parental feeding practices on child food intake and weight status after obesity treatment among preschoolers. Neither changes in feeding practices nor changes in child eating patterns could explain why the parent group with boosters was more effective in reducing children's weight status in the ML study. Because intermediary processes involving parenting practices and parent-child interactions may be important, future studies should examine whether general parenting practices moderate the effect of feeding practices on child weight status. Moreover, from a methodological point of view, our results suggest that instruments that include more nuanced categories for feeding practices should be considered in future research.

Abbreviations

CFQ: Child Feeding Questionnaire; FFQ: Food Frequency Questionnaire; BMI SDS: Body Mass Index; SD: standard deviation; RCT: Randomized Controlled Trial; ML: the More and Less study

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Authors' contributions

PN conceived the study, designed the statistical approach together with MS and supervised the coordination of the study and manuscript process. MS performed the statistical analyses with guidance from KS and drafted the initial manuscript. KS and KE interpreted data and edited the manuscript. AE and PS made a substantial contribution to conception and design, data collection and to interpretation of data. All authors contributed to reviewing and approving the final manuscript.

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Declarations of interest

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1510 567 **References**

1513 568

- 1515 569 Altman, M., & Wilfley, D. E. (2015). Evidence update on the treatment of overweight and obesity in
1516 570 children and adolescents. *J Clin Child Adolesc Psychol*, *44*, 521-537.
- 1517 571 Ashcroft, J., Semmler, C., Carnell, S., van Jaarsveld, C. H., & Wardle, J. (2008). Continuity and stability
1518 572 of eating behaviour traits in children. *Eur J Clin Nutr*, *62*, 985-990.
- 1519 573 Best, J. R., Goldschmidt, A. B., Mockus-Valenzuela, D. S., Stein, R. I., Epstein, L. H., & Wilfley, D. E.
1520 574 (2016). Shared weight and dietary changes in parent-child dyads following family-based
1521 575 obesity treatment. *Health Psychol*, *35*, 92-95.
- 1522 576 Birch, L. L., Fisher, J. O., & Davison, K. K. (2003). Learning to overeat: maternal use of restrictive
1523 577 feeding practices promotes girls' eating in the absence of hunger. *Am J Clin Nutr*, *78*, 215-
1524 578 220.
- 1525 579 Birch, L. L., Fisher, J. O., Grimm-Thomas, K., Markey, C. N., Sawyer, R., & Johnson, S. L. (2001).
1526 580 Confirmatory factor analysis of the Child Feeding Questionnaire: a measure of parental
1527 581 attitudes, beliefs and practices about child feeding and obesity proneness. *Appetite*, *36*, 201-
1528 582 210.
- 1529 583 Blissett, J. (2011). Relationships between parenting style, feeding style and feeding practices and fruit
1530 584 and vegetable consumption in early childhood. *Appetite*, *57*, 826-831.

1535
1536
1537 585 Blissett, J., & Bennett, C. (2013). Cultural differences in parental feeding practices and children's
1538 586 eating behaviours and their relationships with child BMI: a comparison of Black Afro-
1539 587 Caribbean, White British and White German samples. *Eur J Clin Nutr*, 67, 180-184.
1540 588 Boots, S. B., Tiggemann, M., & Corsini, N. (2018). Eating in the absence of hunger in young children:
1541 589 The role of maternal feeding strategies. *Appetite*, 130, 45-49.
1542 590 Burrows, T., Warren, J. M., & Collins, C. E. (2010). The impact of a child obesity treatment
1543 591 intervention on parent child-feeding practices. *Int J Pediatr Obes*, 5, 43-50.
1544 592 Byrne, R., Bell, L., Taylor, R. W., Mauch, C., Mihrshahi, S., Zarnowiecki, D., Hesketh, K. D., Wen, L. M.,
1545 593 Trost, S. G., & Golley, R. (2019). Brief tools to measure obesity-related behaviours in children
1546 594 under 5 years of age: A systematic review. *Obes Rev*, 20, 432-447.
1547 595 Cardel, M., Willig, A. L., Dulin-Keita, A., Casazza, K., Mark Beasley, T., & Fernández, J. R. (2012).
1548 596 Parental feeding practices and socioeconomic status are associated with child adiposity in a
1549 597 multi-ethnic sample of children. *Appetite*, 58, 347-353.
1550 598 Carnell, S., & Wardle, J. (2008). Appetite and adiposity in children: evidence for a behavioral
1551 599 susceptibility theory of obesity. *Am J Clin Nutr*, 88, 22-29.
1552 600 Cole, T. J., Bellizzi, M. C., Flegal, K. M., & Dietz, W. H. (2000). Establishing a standard definition for
1553 601 child overweight and obesity worldwide: international survey. *Bmj*, 320, 1240-1243.
1554 602 Cole, T. J., & Lobstein, T. (2012). Extended international (IOTF) body mass index cut-offs for thinness,
1555 603 overweight and obesity. *Pediatr Obes*, 7, 284-294.
1556 604 Collins, C., Duncanson, K., & Burrows, T. (2014). A systematic review investigating associations
1557 605 between parenting style and child feeding behaviours. *J Hum Nutr Diet*, 27, 557-568.
1558 606 Colquitt, J. L., Loveman, E., O'Malley, C., Azevedo, L. B., Mead, E., Al-Khudairy, L., Ells, L. J.,
1559 607 Metzendorf, M. I., & Rees, K. (2016). Diet, physical activity, and behavioural interventions for
1560 608 the treatment of overweight or obesity in preschool children up to the age of 6 years.
1561 609 *Cochrane Database Syst Rev*, 3, Cd012105.
1562 610 Derks, I. P., Tiemeier, H., Sijbrands, E. J., Nicholson, J. M., Voortman, T., Verhulst, F. C., Jaddoe, V. W.,
1563 611 & Jansen, P. W. (2017). Testing the direction of effects between child body composition and
1564 612 restrictive feeding practices: results from a population-based cohort. *Am J Clin Nutr*, 106,
1565 613 783-790.
1566 614 DiSantis, K. I., Hodges, E. A., Johnson, S. L., & Fisher, J. O. (2011). The role of responsive feeding in
1567 615 overweight during infancy and toddlerhood: a systematic review. *International Journal of*
1568 616 *Obesity*, 35, 480.
1569 617 Doring, N., Hansson, L. M., Andersson, E. S., Bohman, B., Westin, M., Magnusson, M., Larsson, C.,
1570 618 Sundblom, E., Willmer, M., Blennow, M., Heitmann, B. L., Forsberg, L., Wallin, S., Tynelius, P.,
1571 619 Ghaderi, A., & Rasmussen, F. (2014). Primary prevention of childhood obesity through
1572 620 counselling sessions at Swedish child health centres: design, methods and baseline sample
1573 621 characteristics of the PRIMROSE cluster-randomised trial. *BMC Public Health*, 14, 335.
1574 622 Duncanson, K., Burrows, T. L., & Collins, C. E. (2016). Child Feeding and Parenting Style Outcomes and
1575 623 Composite Score Measurement in the 'Feeding Healthy Food to Kids Randomised Controlled
1576 624 Trial'. *Children (Basel)*, 3.
1577 625 Duncanson, K., Shrewsbury, V. A., Collins, C. E., & Consortium, D.-C. (2017). Interim Report on the
1578 626 Effectiveness of Dietary Interventions for Children and Adolescents with Overweight and
1579 627 Obesity for the World Health Organization. In.
1580 628 Ek, A., Chamberlain, K. L., Ejderhamn, J., Fisher, P. A., Marcus, C., Chamberlain, P., & Nowicka, P.
1581 629 (2015). The More and Less Study: a randomized controlled trial testing different approaches
1582 630 to treat obesity in preschoolers. *BMC Public Health*, 15, 735.
1583 631 Ek, A., Lewis Chamberlain, K., Sorjonen, K., Hammar, U., Etminan Malek, M., Sandvik, P., Somaraki,
1584 632 M., Nyman, J., Lindberg, L., Nordin, K., Ejderhamn, J., Fisher, P. A., Chamberlain, P., Marcus,
1585 633 C., & Nowicka, P. (2019). A Parent Treatment Program for Preschoolers With Obesity: A
1586 634 Randomized Controlled Trial. *Pediatrics*, 144.
1587 635 Ek, A., Sorjonen, K., Eli, K., Lindberg, L., Nyman, J., Marcus, C., & Nowicka, P. (2016). Associations
1588 636 between Parental Concerns about Preschoolers' Weight and Eating and Parental Feeding

1594
1595
1596 637 Practices: Results from Analyses of the Child Eating Behavior Questionnaire, the Child
1597 638 Feeding Questionnaire, and the Lifestyle Behavior Checklist. *PLoS One*, 11, e0147257.
1598 639 Eli, K., Howell, K., Fisher, P. A., & Nowicka, P. (2016). A question of balance: Explaining differences
1599 640 between parental and grandparental perspectives on preschoolers' feeding and physical
1600 641 activity. *Soc Sci Med*, 154, 28-35.
1601 642 Enghardt Barbieri, H., Pearson, M., & Becker, W. (2006). Riksmatern-barn 2003: Livsmedels-och
1602 643 näringsintag bland barn i Sverige. In.
1603 644 Epstein, L. H., Paluch, R. A., Beecher, M. D., & Roemmich, J. N. (2008). Increasing healthy eating vs.
1604 645 reducing high energy-dense foods to treat pediatric obesity. *Obesity (Silver Spring)*, 16, 318-
1605 646 326.
1606 647 Farrow, C., Blissett, J., & Haycraft, E. (2011). Does child weight influence how mothers report their
1607 648 feeding practices? *Int J Pediatr Obes*, 6, 306-313.
1608 649 Fisher, J. O., & Birch, L. L. (1999). Restricting access to palatable foods affects children's behavioral
1609 650 response, food selection, and intake. *Am J Clin Nutr*, 69, 1264-1272.
1610 651 Foster, B. A., Farragher, J., Parker, P., & Sosa, E. T. (2015). Treatment Interventions for Early
1611 652 Childhood Obesity: A Systematic Review. *Acad Pediatr*, 15, 353-361.
1612 653 Galloway, A. T., Fiorito, L., Lee, Y., & Birch, L. L. (2005). Parental pressure, dietary patterns, and
1613 654 weight status among girls who are "picky eaters". *J Am Diet Assoc*, 105, 541-548.
1614 655 Galloway, A. T., Fiorito, L. M., Francis, L. A., & Birch, L. L. (2006). 'Finish your soup': counterproductive
1615 656 effects of pressuring children to eat on intake and affect. *Appetite*, 46, 318-323.
1616 657 Golan, M., Kaufman, V., & Shahar, D. R. (2006). Childhood obesity treatment: targeting parents
1617 658 exclusively v. parents and children. *Br J Nutr*, 95, 1008-1015.
1618 659 Golley, R. K., Bell, L. K., Hendrie, G. A., Rangan, A. M., Spence, A., McNaughton, S. A., Carpenter, L.,
1619 660 Allman-Farinelli, M., de Silva, A., Gill, T., Collins, C. E., Truby, H., Flood, V. M., & Burrows, T.
1620 661 (2017). Validity of short food questionnaire items to measure intake in children and
1621 662 adolescents: a systematic review. *J Hum Nutr Diet*, 30, 36-50.
1622 663 Gordon, R. A. (2015). Measuring Constructs in Family Science: How Can Item Response Theory
1623 664 Improve Precision and Validity? *Journal of Marriage and Family*, 77, 147-176.
1624 665 Gubbels, J. S., Kremers, S. P., Stafleu, A., de Vries, S. I., Goldbohm, R. A., Dagnelie, P. C., de Vries, N.
1625 666 K., van Buuren, S., & Thijs, C. (2011). Association between parenting practices and children's
1626 667 dietary intake, activity behavior and development of body mass index: the KOALA Birth
1627 668 Cohort Study. *Int J Behav Nutr Phys Act*, 8, 18.
1628 669 Haszard, J. J., Skidmore, P. M., Williams, S. M., & Taylor, R. W. (2015). Associations between parental
1629 670 feeding practices, problem food behaviours and dietary intake in New Zealand overweight
1630 671 children aged 4-8 years. *Public Health Nutr*, 18, 1036-1043.
1631 672 Hayes, J. F., Altman, M., Kolko, R. P., Balantekin, K. N., Holland, J. C., Stein, R. I., Saelens, B. E., Welch,
1632 673 R. R., Perri, M. G., Schechtman, K. B., Epstein, L. H., & Wilfley, D. E. (2016). Decreasing food
1633 674 fussiness in children with obesity leads to greater weight loss in family-based treatment.
1634 675 *Obesity (Silver Spring)*, 24, 2158-2163.
1635 676 Holland, J. C., Kolko, R. P., Stein, R. I., Welch, R. R., Perri, M. G., Schechtman, K. B., Saelens, B. E.,
1636 677 Epstein, L. H., & Wilfley, D. E. (2014). Modifications in parent feeding practices and child diet
1637 678 during family-based behavioral treatment improve child zBMI. *Obesity (Silver Spring)*, 22,
1638 679 E119-126.
1639 680 Hubbs-Tait, L., Kennedy, T. S., Page, M. C., Topham, G. L., & Harrist, A. W. (2008). Parental feeding
1640 681 practices predict authoritative, authoritarian, and permissive parenting styles. *J Am Diet*
1641 682 *Assoc*, 108, 1154-1161; discussion 1161-1152.
1642 683 Jansen, E., Williams, K. E., Mallan, K. M., Nicholson, J. M., & Daniels, L. A. (2018). Bidirectional
1643 684 associations between mothers' feeding practices and child eating behaviours. *Int J Behav*
1644 685 *Nutr Phys Act*, 15, 3-3.
1645 686 Jansen, P. W., de Barse, L. M., Jaddoe, V. W. V., Verhulst, F. C., Franco, O. H., & Tiemeier, H. (2017).
1646 687 Bi-directional associations between child fussy eating and parents' pressure to eat: Who
1647 688 influences whom? *Physiol Behav*, 176, 101-106.
1648
1649
1650
1651
1652

1653
1654
1655 689 Khandpur, N., Blaine, R. E., Fisher, J. O., & Davison, K. K. (2014). Fathers' child feeding practices: a
1656 690 review of the evidence. *Appetite*, 78, 110-121.
1657 691 Kleber, M., Schaefer, A., Winkel, K., Hoffmann, D., Wunsch, R., Kersting, M., & Reinehr, T. (2009).
1658 692 Lifestyle intervention "Obeldicks Mini" for obese children aged 4 to 7 years. *Klin Padiatr*, 221,
1659 693 290-294.
1660 694 Kuhl, E. S., Clifford, L. M., Bandstra, N. F., Filigno, S. S., Yeomans-Maldonado, G., Rausch, J. R., &
1661 695 Stark, L. J. (2014). Examination of the association between lifestyle behavior changes and
1662 696 weight outcomes in preschoolers receiving treatment for obesity. *Health Psychol*, 33, 95-98.
1663 697 Loveman, E., Al-Khudairy, L., Johnson, R. E., Robertson, W., Colquitt, J. L., Mead, E. L., Ells, L. J.,
1664 698 Metzendorf, M. I., & Rees, K. (2015). Parent-only interventions for childhood overweight or
1665 699 obesity in children aged 5 to 11 years. *Cochrane Database Syst Rev*, Cd012008.
1666 700 Mazzeo, S. E., Kelly, N. R., Stern, M., Gow, R. W., Cotter, E. W., Thornton, L. M., Evans, R. K., & Bulik,
1667 701 C. M. (2014). Parent skills training to enhance weight loss in overweight children: evaluation
1668 702 of NOURISH. *Eat Behav*, 15, 225-229.
1669 703 Morgan, P. J., Young, M. D., Lloyd, A. B., Wang, M. L., Eather, N., Miller, A., Murtagh, E. M., Barnes, A.
1670 704 T., & Pagoto, S. L. (2017). Involvement of Fathers in Pediatric Obesity Treatment and
1671 705 Prevention Trials: A Systematic Review. *Pediatrics*, 139.
1672 706 Neuman, N., Eli, K., & Nowicka, P. (2019). Feeding the extended family: gender, generation, and
1673 707 socioeconomic disadvantage in food provision to children. *Food, Culture & Society*, 22, 45-62.
1674 708 Niermann, C. Y. N., Gerards, S., & Kremers, S. P. J. (2018). Conceptualizing Family Influences on
1675 709 Children's Energy Balance-Related Behaviors: Levels of Interacting Family Environmental
1676 710 Subsystems (The LIFES Framework). *Int J Environ Res Public Health*, 15.
1677 711 Nowicka, P., Flodmark, C. E., Hales, D., & Faith, M. S. (2014). Assessment of parental overt and covert
1678 712 control of child's food intake: a population-based validation study with mothers of
1679 713 preschoolers. *Eat Behav*, 15, 673-678.
1680 714 Nowicka, P., Sorjonen, K., Pietrobelli, A., Flodmark, C. E., & Faith, M. S. (2014). Parental feeding
1681 715 practices and associations with child weight status. Swedish validation of the Child Feeding
1682 716 Questionnaire finds parents of 4-year-olds less restrictive. *Appetite*, 81, 232-241.
1683 717 Ogden, J., Reynolds, R., & Smith, A. (2006). Expanding the concept of parental control: a role for
1684 718 overt and covert control in children's snacking behaviour? *Appetite*, 47, 100-106.
1685 719 Okely, A. D., Collins, C. E., Morgan, P. J., Jones, R. A., Warren, J. M., Cliff, D. P., Burrows, T. L., Colyvas,
1686 720 K., Steele, J. R., & Baur, L. A. (2010). Multi-Site Randomized Controlled Trial of a Child-
1687 721 Centered Physical Activity Program, a Parent-Centered Dietary-Modification Program, or
1688 722 Both in Overweight Children: The HIKCUPS Study. *J Pediatr*, 157, 388-394.e381.
1689 723 Pfister, R., Schwarz, K., Carson, R., & Janczyk, M. (2013). Easy methods for extracting individual
1690 724 regression slopes: Comparing SPSS, R, and Excel. *Tutorials in Quantitative Methods for*
1691 725 *Psychology*, 9, 72-78.
1692 726 Powell, F., Farrow, C., Meyer, C., & Haycraft, E. (2018). The Stability and Continuity of Maternally
1693 727 Reported and Observed Child Eating Behaviours and Feeding Practices across Early
1694 728 Childhood. *Int J Environ Res Public Health*, 15, 1017.
1695 729 Pratt, M., Hoffmann, D., Taylor, M., & Musher-Eizenman, D. (2017). Structure, coercive control, and
1696 730 autonomy promotion: A comparison of fathers' and mothers' food parenting strategies. *J*
1697 731 *Health Psychol*, 1359105317707257.
1698 732 Robson, S. M., Ziegler, M. L., McCullough, M. B., Stough, C. O., Zion, C., Simon, S. L., Ittenbach, R. F., &
1699 733 Stark, L. J. (2019). Changes in diet quality and home food environment in preschool children
1700 734 following weight management. *International Journal of Behavioral Nutrition and Physical*
1701 735 *Activity*, 16, 16.
1702 736 Rodenburg, G., Kremers, S. P., Oenema, A., & van de Mheen, D. (2012). Associations of children's
1703 737 appetitive traits with weight and dietary behaviours in the context of general parenting. *PLoS*
1704 738 *One*, 7, e50642.
1705
1706
1707
1708
1709
1710
1711

1712
1713
1714 739 Rodenburg, G., Kremers, S. P., Oenema, A., & van de Mheen, D. (2014). Associations of parental
1715 740 feeding styles with child snacking behaviour and weight in the context of general parenting.
1716 741 *Public Health Nutr*, 17, 960-969.
1717 742 Rodgers, R. F., Paxton, S. J., Massey, R., Campbell, K. J., Wertheim, E. H., Skouteris, H., & Gibbons, K.
1718 743 (2013). Maternal feeding practices predict weight gain and obesogenic eating behaviors in
1719 744 young children: a prospective study. *Int J Behav Nutr Phys Act*, 10, 24.
1720 745 Rollins, B. Y., Loken, E., Savage, J. S., & Birch, L. L. (2014). Effects of restriction on children's intake
1721 746 differ by child temperament, food reinforcement, and parent's chronic use of restriction.
1722 747 *Appetite*, 73, 31-39.
1723 748 Rollins, B. Y., Loken, E., Savage, J. S., & Birch, L. L. (2014). Maternal controlling feeding practices and
1724 749 girls' inhibitory control interact to predict changes in BMI and eating in the absence of
1725 750 hunger from 5 to 7 y. *Am J Clin Nutr*, 99, 249-257.
1726 751 Rollins, B. Y., Savage, J. S., Fisher, J. O., & Birch, L. L. (2016). Alternatives to restrictive feeding
1727 752 practices to promote self-regulation in childhood: a developmental perspective. *Pediatr*
1728 753 *Obes*, 11, 326-332.
1730 754 Russell, C. G., Haszard, J. J., Taylor, R. W., Heath, A. M., Taylor, B., & Campbell, K. J. (2018). Parental
1731 755 feeding practices associated with children's eating and weight: What are parents of toddlers
1732 756 and preschool children doing? *Appetite*.
1733 757 Russell, C. G., Taki, S., Laws, R., Azadi, L., Campbell, K. J., Elliott, R., Lynch, J., Ball, K., Taylor, R., &
1734 758 Denney-Wilson, E. (2016). Effects of parent and child behaviours on overweight and obesity
1735 759 in infants and young children from disadvantaged backgrounds: systematic review with
1736 760 narrative synthesis. *BMC Public Health*, 16, 151.
1737 761 Sandvik, P., Ek, A., Eli, K., Somaraki, M., Bottai, M., & Nowicka, P. (2019). Picky eating in an obesity
1738 762 intervention for preschool-aged children – what role does it play, and does the measurement
1739 763 instrument matter? *International Journal of Behavioral Nutrition and Physical Activity*, 16, 76.
1740 764 Shloim, N., Edelson, L. R., Martin, N., & Hetherington, M. M. (2015). Parenting Styles, Feeding Styles,
1741 765 Feeding Practices, and Weight Status in 4-12 Year-Old Children: A Systematic Review of the
1742 766 Literature. *Front Psychol*, 6, 1849.
1743 767 Sleddens, E. F., Kremers, S. P., Stafleu, A., Dagnelie, P. C., De Vries, N. K., & Thijs, C. (2014). Food
1744 768 parenting practices and child dietary behavior. Prospective relations and the moderating role
1745 769 of general parenting. *Appetite*, 79, 42-50.
1746 770 SLL. (2016). Primary Child Health Care Report 2016. In. Mottala: Stockholm County Sweden.
1747 771 Somaraki, M., Eli, K., Ek, A., Lindberg, L., Nyman, J., Marcus, C., Flodmark, C. E., Pietrobelli, A., Faith,
1748 772 M. S., Sorjonen, K., & Nowicka, P. (2016). Controlling feeding practices and maternal migrant
1749 773 background: an analysis of a multicultural sample. *Public Health Nutr*, 1-11.
1750 774 Stark, L. J., Clifford, L. M., Towner, E. K., Filigno, S. S., Zion, C., Bolling, C., & Rausch, J. (2014). A pilot
1751 775 randomized controlled trial of a behavioral family-based intervention with and without home
1752 776 visits to decrease obesity in preschoolers. *J Pediatr Psychol*, 39, 1001-1012.
1753 777 Stark, L. J., Spear Filigno, S., Bolling, C., Ratcliff, M. B., Kichler, J. C., Robson, S. M., Simon, S. L.,
1754 778 McCullough, M. B., Clifford, L. M., Odar Stough, C., Zion, C., & Ittenbach, R. F. (2018). Clinic
1755 779 and Home-Based Behavioral Intervention for Obesity in Preschoolers: A Randomized Trial. *J*
1756 780 *Pediatr*, 192, 115-121.e111.
1757 781 Steele, R. G., Jensen, C. D., Gayes, L. A., & Leibold, H. C. (2014). Medium is the message: moderate
1758 782 parental control of feeding correlates with improved weight outcome in a pediatric obesity
1759 783 intervention. *J Pediatr Psychol*, 39, 708-717.
1760 784 Tan, C. C., Domoff, S. E., Pesch, M. H., Lumeng, J. C., & Miller, A. L. (2019). Coparenting in the feeding
1761 785 context: perspectives of fathers and mothers of preschoolers. *Eat Weight Disord*.
1762 786 Vaughn, A. E., Ward, D. S., Fisher, J. O., Faith, M. S., Hughes, S. O., Kremers, S. P., Musher-Eizenman,
1763 787 D. R., O'Connor, T. M., Patrick, H., & Power, T. G. (2016). Fundamental constructs in food
1764 788 parenting practices: a content map to guide future research. *Nutr Rev*, 74, 98-117.

1771

1772

1773 789 Wehrly, S. E., Bonilla, C., Perez, M., & Liew, J. (2014). Controlling parental feeding practices and child
1774 790 body composition in ethnically and economically diverse preschool children. *Appetite*, 73,
1775 791 163-171.

1776 792 Ventura, A. K., & Birch, L. L. (2008). Does parenting affect children's eating and weight status? *Int J*
1777 793 *Behav Nutr Phys Act*, 5, 15.

1778 794 West, F., Sanders, M. R., Cleghorn, G. J., & Davies, P. S. (2010). Randomised clinical trial of a family-
1779 795 based lifestyle intervention for childhood obesity involving parents as the exclusive agents of
1780 796 change. *Behav Res Ther*, 48, 1170-1179.

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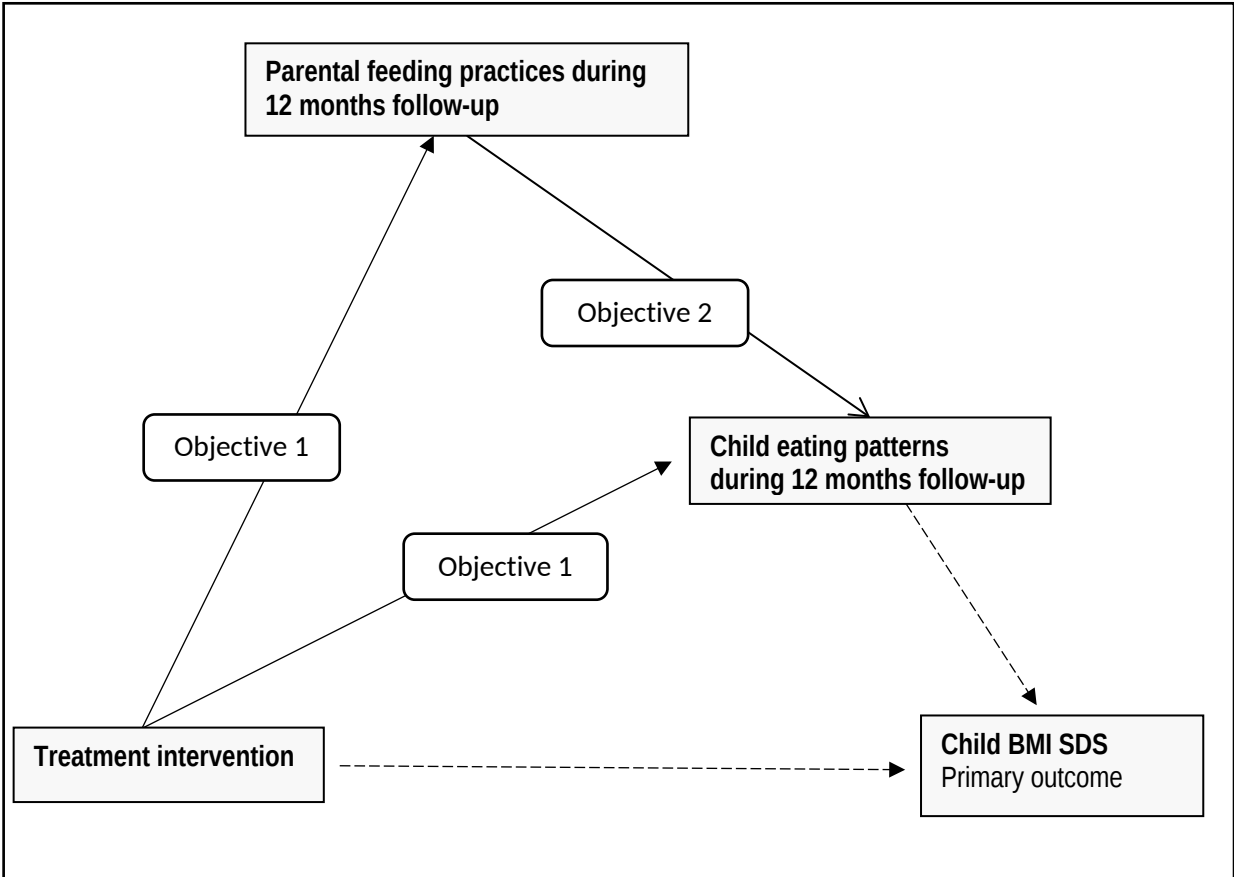
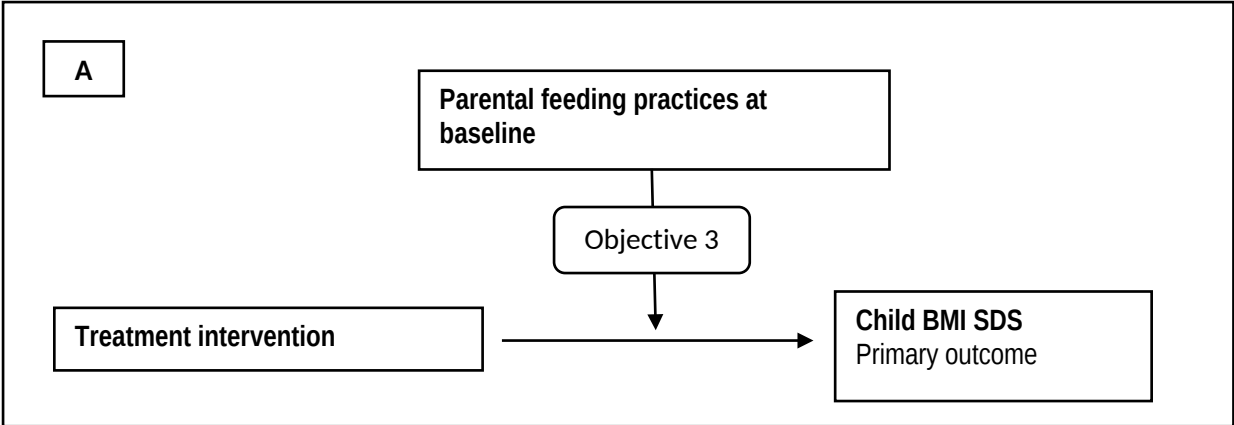
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Ethical statement

The More and Less study (ML study) described in the attached manuscript was approved by the ethics committee in Stockholm, Sweden on November 16th 2011 (dnr: 2011/1329-31/4).

All participating caregivers provided written informed consent on behalf of their children.