**Mother-child interactions during feeding:**

**a study on maternal sensitivity in dyads with underweight and normal weight toddlers**

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**Abstract**

During the second year of life, mother’s sensitivity in encouraging child autonomy supports children’s emotional-affective individuation. In the feeding context, there is a clear transition from dependence on the mother to an emerging autonomy. Several studies have found an association between children's poor growth which is not related to organic pathologies, and maladaptive mother-child interactions that are characterized by poor maternal sensitivity. Despite this evidence, no studies have investigated maternal sensitivity to specific child's cues, such as demands for autonomy, during feeding interactions between mothers and their underweight children. This study aimed to assess how mothers’ psychopathological risk and toddler’s dysregulation profile are associated with mother-toddler interactional quality during feeding, with particular attention to mothers’ sensitivity to child’s specific cues (e.g. need of autonomy, requests for cooperation, request to stop the interaction, etc.). One hundred fifty mother-toddler dyads (N=73 with underweight children and N=77 with normal weight children) with children aged between 18 and 30 months, were recruited. Mother-toddlers feeding interactions were assessed through specific rating scales applied to the video-recorded interactions and mothers filled out questionnaires on children's emotional-behavioral functioning and their own psychopathological risk. Results showed a significant association between the quality of mother-toddler feeding interaction and children’s weight. Underweight children showed less demand for autonomy and request for cooperation than normal weight children. Moreover, mothers of underweight children were less sensitive to toddler’s cues of wanting to stop the interaction and demands for autonomy compared to mothers of normal weight children. Lower facilitations were associated with toddler’s more dysregulated profile and with mother’s higher psychopathological risk, and high toddler’s dysregulation profile was associated with lower maternal sensitivity to child’s cues of wanting to interrupt interactions and with worse mother’s mood. Assessing maternal sensitivity in relation to toddler’s specific cues might be particularly relevant in the feeding context. It might help to detect some dysfunctional interactive patterns and allow the implementation of prevention and treatment programs.

**Keywords**

Feeding interactions; Mother-child interactions; Sensitivity; Underweight children; Toddlers’ autonomy

**1. Introduction**

During early childhood, feeding interactions provide coherent and predictable opportunities for social exchanges structured by caregivers, where children learn how to recognize and understand their own hunger and satiety cues (Black & Aboud, 2011). Although in recent decades the literature has re-evaluated the paternal role in the child's psycho-emotional development (Kvalevaag, Ramchandani, Hove, Assmus, Eberhard-Gran, & Biringer, 2013; Ramchandani & Psychogiou, 2009), studies on feeding interactions in early childhood have focused primarily on the maternal role (see Cerniglia, Cimino, & Ballarotto, 2014, for an exception). Indeed, in adaptive feeding interactions effective self-regulation is supported by mothers who accompany children in the transition from mutual regulation and dependence on the adult (in the first year of life) to independent nutrition (which begins at the end of the first year), characterized by greater self-regulation and an emerging autonomy (Sander, 1977). Thus early feeding interactions represent an organizer not only of biological rhythms, but also of the development of the Self (Ammaniti, Lucarelli, Cimino, D’Olimpio, & Chatoor, 2010; Feldman, 2007; Stern, 1985).

During this sensitive time of growing independency, it may be increasingly difficult for mothers to understand some of the child's cues, such as requests for autonomy in managing the pace of food intake (e.g. speed, quantity, pauses, interruptions) and the exploration of the food itself, causing conflicts between caregiver and children during feeding. In turn, such conflictual interactions might lead to the child rejecting food (Chatoor et al., 1998; Galloway et al., 2006; Powell et al., 2011; Salvatori et al., 2015) which, if persistent, could lead to inadequate growth. Poor growth in childhood is termed “failure to thrive” and this condition includes children who are underweight, those who lose of weight or do not gain sufficient weight over time (Jaffe, 2011; Puls et al., 2018). Indeed, several studies have found an association between children with failure to thrive and a maladaptive mother-child relationship (Chatoor, Hirsch, Ganiban, Persinger, & Hamburger, 1998; Chatoor, 2002). Instead, it has been shown that sensitive caregiving, which is defined as the ability to recognise infant’s cues and to respond promptly and appropriately to them (Ainsworth, Bell, & Stayton, 1974) is fundamental in this phase of emotional-affective individuation. In the feeding context, recognizing, responding and encouraging children’s need for autonomy has been demonstrated to promote adaptive feeding interactions (Farrow & Blissett, 2014; Halligan et al., 2013; Powell et al., 2011). While various studies have focused on global maternal sensitivity or maternal specific behaviors during feeding interactions (Atzaba-Poria et al., 2010; Bergmeier et al., 2015; Bilgin et al., 2017; Farrow & Blissett, 2014), to our knowledge there are no studies investigating maternal sensitive responsiveness to specific child’s cues, such as demands for autonomy.

*1.1 Underweight children*

Children are classified as underweight when they are in the bottom 5th percentile for weight compared to their height and compared to other children their age (Bauchner, 2007). Being underweight is a risk factor not only for later worse physical growth and health, but also for poor child socio-emotional and cognitive outcomes (Uzogara, 2016; Henninger, 2008; Henninger & Luze, 2010; Vaivada et al., 2017).

Being underweight, as well as having difficulties gaining weight or maintaining weight, is part of a condition called “failure to thrive” (Jaffe, 2011; Puls et al., 2018) which can have organic and nonorganic causes (Chatoor & Egan, 1983). Several studies have found a relationship between nonorganic cases and poor quality of mother–child interactions characterized by conflict, over control by caregivers and less autonomy granted and encouragement to children when eating (Chatoor et al., 1998; Chatoor, 2002; Keren, 2016; Powell et al., 2011). Indeed, it has been observed that parents of children with eating disorders and showing food refusal often tend to feed them based on their own perception of what and how much the child should eat, overlooking children’s requests for autonomy and appearing as more intrusive (Atzaba-Poria et al., 2010; Keren, 2016; Galloway et al., 2006). Even though literature on eating disorders suggests that difficulties might lie in the quality of the feeding interactions between caregivers and children, there are not many studies we are aware of specifically on groups of underweight children (see Gueron-Sela et al., 2011 for an exception). Relational aspects of feeding interactions with children with poor growth not due to organic pathologies is relevant in order to be able to structure preventive and therapeutic interventions that can take into consideration the mother-child dyad. In fact, several studies have shown the effectiveness of psychotherapeutic interventions focused on the mother-child dyad (Mitchell et al., 2013; Tambelli, Cerniglia, Cimino, & Ballarotto, 2015; Muir, 1992) on quality of feeding interactions and on changing a dysfunctional relational system, leading to an improvement in the child's nutrition. Therefore, to better tailor interventions, it is crucial to understand which elements of feeding interactions have the greatest impact on children outcomes.

*1.2 Mother-toddler feeding interactions: maternal and child contribution*

Several studies have shown that mothers of children who show food refusal have more dysfunctional feeding interactions with their children (Dinkevich et al. 2015; Powell, Farrow, & Meyer, 2011) and higher maternal psychopathological risk (Porreca et al., 2018; Gueron-Sela, Atzaba-Poria, Meiri, & Yerushalmi, 2011) than mothers of children with no feeding problems. Indeed, maternal psychopathology appears to be connected to maladaptive mother-child interactions in non-feeding contexts and during meals, especially in the first two years of life (Ierardi et al., 2019, Messina et al., 2020; Murray, Halligan, & Cooper, 2010): mothers with psychopathological risk symptoms, such as low mood, anxiety, could show difficulty in responding contingently to the new abilities and signals shown by their children at particular development stages, such as during weaning and at the beginning of autonomous feeding (Ammaniti et al., 2010; Cimino et al., 2016; Eiden, 2001; Stein, Woolley, Cooper, & Fairburn, 1994). Furthermore, failures in mother-child communication have been proved to interfere with the transition to autonomous nutrition and to lead to highly conflicting interactions (Chatoor, Ganiban, Hirsch, Borman-Spurrell, & Mrazek, 2000). For example, mother’s overcontrol and concerns related to the toddler’s growing autonomy (such as, for example, the exploration of food, preferences for specific food, preferences for specific feeding patterns) could trigger anxiety in the toddler and lead to the rejection of food (Chatoor et al., 1998). Often, mothers show difficulties in responding to toddler’s cues, specifically to those cues that imply a child’s choice, which modifies the interactive relationship (signs of satiety, wanting to experiment autonomously with food, etc.). Therefore, being able to support toddler’s autonomy in this phase might be a protective factor for the possible onset of a psychopathological or relational disorder. On the other hand, in the second year of life toddler’s cues are more differentiated than in the first, and clearly represent different needs (e.g. autonomy, interrupting interactions with mother, reassurance, cooperation etc.). Parents could respond sensitively to some of them but not to others. Although a few studies have focused on maternal sensitive responsiveness to distressed vs. non-distressed cues showing how mothers might respond differently to them (Leerkes, Weaver, & O'Brien, 2012; McElwain, & Booth-LaForce, 2006), sensitivity to more specific needs (such as autonomy, cooperation, reassurance, etc.) has not received research attention.

Based on the transactional model of development (Sameroff, 2009), individual maternal characteristics as well as children’s individual characteristics could influence maternal sensitivity in capturing child's different cues during interactions and her responsiveness to it. Recent studies have stressed the importance of taking into account a dysregulation profile in childhood, characterized by impaired self-regulation in affective, behavioral, and cognitive components (Althoff, Verhulst, Rettew, Hudziak, & van der Ende, 2010; Geeraerts et al., 2015; Holtmann et al. 2011). In the context of feeding, children who suffers from emotional and behavioral problems might be sending fewer clear signals which might be more challenging to respond to compared to regulated peers, and this might lead to difficulties in the interactions. A comprehensive understanding of the type of cues children send to mothers during feeding, the contribution of their emotional and behavioral well-being (i.e. dysregulation profile) as well as maternal psychological well-being (i.e. psychopathological risk) and of the interactive style during feeding (e.g. sensitivity, intrusiveness, facilitation) might help designing targeted interventions considering all the implicated aspects.

*1.3 The present study*

The present study aims to assess the quality of mother-toddler interactions during feeding both in a sample of both underweight and normal weight children.

Based on previous studies (Leerkes, Weaver, & O'Brien, 2012) we assume that maternal sensitivity to different child’s cues may be a relational construct, influenced by characteristics of the parent, the child and the relationship. Therefore, we aim to assess how mothers’ psychopathological risk and toddler’s dysregulation profile interact to contribute to mother-toddler interactional quality during feeding, with particular attention to mothers’ sensitive responsiveness to child’s specific cues (e.g. need of autonomy, requests for cooperation, request to stop the interaction, etc.). Since no tools were found to assess maternal sensitivity to child’s specific cues and needs, an observational tool (described in the method section) was developed to capture the contribution of it when assessing mother-toddler interactive quality.

Specifically, based on previous literature, we hypothesized that:

1) underweight children (without organic causes) have more maladaptive feeding interactions with their mothers than normal weight children assessed using a global rating scale;

2) mothers of underweight children have greater difficulty during interactions than mothers of children with normal weight, resulting in lower level of sensitivity, higher level of intrusiveness, lower level of facilitations showed by mothers;

3) children’s emotional-behavioral difficulties and maternal psychopathological risk negatively influence the quality of feeding interaction (specifically on aspects of interaction such as sensitivity to the different toddler’s cues, facilitations, intrusiveness and reciprocity).

There was no prior hypothesis regarding group differences in maternal sensitivity to specific child's cues given the lack of exiting literature in this area.

**2. Methods**

*2.1 Sample and procedure*

The sample includes 150 Italian mother-toddler dyads, of which 73 with mothers of underweight children (UW group), and 77 with mothers of normal weight children (NW group). Children’s age ranged from 18 to 30 months. The UW group was selected in the Clinical Nutrition Services of the pediatric hospitals in Central Italy. The diagnosis of underweight was made by pediatricians, before any proposals for treatment were made. The diagnosis was based on the criteria defined by the International Obesity Task Force (IOTF), which proposed an international Body Mass Index (BMI, kg/m2) reference standard to define underweight, overweight, and obesity according to subjects’ height and age (Cole, Flegal, Nicholls, & Jackson, 2007; Cole & Lobstein, 2012). Children included in the present sample had a weight below the third percentile and they had not taken part in any psychological and/or pharmacological treatment. Furthermore, inclusion criteria were no comorbidity with physical or mental disorders, full-term birth, no previous medical or psychological treatment.

The NW group was sampled from public and private kindergartens. Meetings with parents were organized, in which the objectives and the various phases of the research project were described (participants’ adherence rate: 84%). Inclusion criteria was children’s normal growth rate, with no physical or mental disorders, gestational age in the normal range. This information was provided by the mothers, who filled in an anamnestic questionnaire constructed ad hoc for this study. Furthermore, mothers with current or previous psychopathological disorders were excluded from the research (n= 2 dyads with mothers suffering from eating disorders and n= 3 dyads with mothers suffered of perinatal depression disorders were excluded from the study). To assess current maternal psychological disorders, the SCID I (Non-Patient Edition; First, Spitzer, Gibbon, & Williams, 2002) was administered to the mothers. Furthermore, to assess previous psychopathological disorders, a specific section has been included in the anamnestic questionnaire filled in by mothers. The NW group was paired with the UW group for age (both mother’s and child’s age). Table 1 shows sample’s sociodemographic characteristics.

|  |  |  |
| --- | --- | --- |
|  | UW group (N = 73) | NW group (N = 77) |
| Children’s sex (Males) | 56.2% | 53.2% |
| Children’s age (M, sd) | 22.9 (4.9) | 20.6 (3.9) |
| Mothers’ age (M, sd) | 32.9 (4.6) | 33.9 (6.3) |
| Order of birth (Firstborn) | 84.0% | 82.5% |
| Breastfeeding (Yes) | 82.2% | 83.5% |
| Marital status (Married) | 80.4% | 78.0% |

Table 1. Sociodemographic characteristics

Mothers who agreed to participate in this study completed and signed an informed consent form in which the various stages of the study were explained in detail. In accordance with the Helsinki Declaration, the study protocol was reviewed and approved before its start by the Ethics Committee of the Department of Dynamic and Clinical Psychology of the University of Rome “La Sapienza” (n. 58/2017).

All mother-child dyads were observed in the laboratory and video-recorded for twenty minutes during a feeding interaction. Mothers were asked to interact with their child during a main meal (including pasta or meat, a fruit and a drink), recreating a typical situation, offering the child the food they were accustomed to consume on a regular basis. For the order of administration, a randomized procedure was used that takes into account the child’s sex. After the mother-child interactions video-recording, mothers filled out self-report questionnaires (described below) for the assessment of their current psychological symptom status and of their children’s emotional-behavioral functioning.

*2.2 Measures*

*2.2.1 Assessment of quality of mother-child feeding interactions*

1) *Maternal sensitivity to child’s specific cues*: in order to assess mother-toddler interactive quality, taking into account the child’s specific cues, an observational tool was developed by the authors: the *Coding Scheme for Toddler-Parent Interaction* (unpublished manual).

As highlighted above, Irene Chatoor's studies (Chatoor & Ganiban, 2003) have shown that children diagnosed with eating disorders have feeding interactions with their mothers characterized by increased conflict, especially relative to the child's requests for greater autonomy or maternal intrusiveness, to which the child responds with requests to stop the interaction. Starting from the behaviors described by Irene Chatoor and from the analytical observation of feeding interactions, a different sensitivity to specific child’s cues was evident. Starting from results of Leerkes and colleagues’ study (2012), that showed that maternal sensitivity during childhood could be further divided into specific sub-types that have unique origins and unique effects on subsequent child well-being, this tool has been developed. Using this coding scheme, a) frequency of child’s cues, b) maternal responses to them rated as present or absent (the latter, in case mothers do not notice their child's cues), and c) quality of such maternal response on a scale between 1 (lowest) and 5 (highest) were assessed. Child’s cues are described in Table 2.

Table 2. Description of child’s different cues observed through the *Coding Scheme for Toddler-Parent Interaction*

|  |  |
| --- | --- |
| **Child’s cues** | **Description** |
| Demand for autonomy  (AUT) | Verbal and non-verbal signals indicating autonomy, or the need for greater autonomy; for instance, the child could indicate the objects that can be used alone (bread, teaspoon, glass), expressing it verbally (e.g. making a request), trying to take the spoon, trying to reach for the glass, manipulating part of the food (e.g. bread, pasta, etc.) by himself, taking the plate from which the mother is handing him the food or the teaspoon, or choosing the food to eat. |
| Wanting to interrupt interactions  (INT) | This category includes behaviors such as avoiding mother's gaze, physically moving away from the mother, pushing away the spoon, the plate or other objects used by the mother to interact with the child, turning his or her head away, covering his mouth (during feeding interactions), crying or verbally making a request to interrupt the interaction. |
| Need for reassurance  (REASS) | In situations of distress, the child could signal the need for reassurance from the mother, e.g. by reaching out to the mother, looking for body contact, extending the arms to his mother, crying. |
| Need for cooperation  (COOP) | During interactions, the child might request mother’s cooperation, either to share an activity with her (e.g. showing a piece of food or the spoon, offering her the food or the teaspoon) or to ask for help (e.g. showing or pointing out the empty glass to the mother, opening her mouth to be fed, asking it verbally or asking verbally to scoop up the food with the spoon). |
| Other cues  (OTHER) | Other signals from the child, such as signals of communication with the parent, frustration (for example, situations where the child cries without requiring explicit reassurance from the parent), exploration (such as interest in the food without asking the parent for support or cooperation) etc. |

The frequency and intensity of child’s cues were rated on a Likert scale with 4 points ranging from 0 (absent) to 3 (many), while maternal sensitivity to the child’s cues was evaluated on a 5-point Likert scale ranging from 1 (very insensitive) to 5 (very sensitive) (i.e. prompt and appropriate responses were considered sensitive as opposed to ill-timed and not-appropriate responses or lack of them which were rated as insensitive). In particular, maternal sensitivity in response to child’s cues of wanting to interrupt interactions (S-INT), of demanding autonomy (S-AUT), of needing reassurance (S-RASS), and cooperation (S-COOP) and to other cues (S-OTHER) were rated.

In addition, other Global Scales have been used to rate overall aspects of mother-child interactions:

2) *Global Sensitivity* was rated using a scale designed by Ainsworth and coll. (1978) which allows the assessment of maternal sensitivity on a 5-point Likert scale from 1 (very insensitive) to 5 (very sensitive). At the lower section of the scale is an extremely insensitive mother, oriented towards their own desires and aims, while at the top of the scale, there is a sensitive mother who in tune with the child’s cues.

3) *Facilitations* (Stein et al., 1994; Stein, Woolley, & McPherson, 1999) which are maternal actions to assist the child in activities in which the child is already involved or has indicated an interest in involvement, were rated. The scale allows the rating of maternal facilitations on the basis of a 5-point Likert scale ranging from 1 (not facilitating) to 5 (very facilitating).

*4) Intrusiveness* (Ainsworth et al., 1978): this scale considers intrusiveness as a constellation of insensitive and interfering maternal behaviours rooted in the maternal lack of respect for the child’s autonomy. At the core of this conceptualization is the notion that a highly intrusive mothers have their own agenda, so they can overwhelm their child with excessive stimulation or interrupt child’s activity to completely stop it or change its course. Maternal intrusiveness is rated on a 5-point Likert scale ranging from 1 (very intrusive) to 5 (non-intrusive).

5) *Reciprocity* (Murray et al., 1996): this scale assesses the reciprocal exchange between mother and child. During a reciprocal interaction, child’s cues are recognized and answered by the mother, and vice versa. A good turn-taking is observed and both members of the dyad take in consideration the other’s suggestions. Reciprocity is rated on a 5-point Likert scale ranging from 1 (absence of reciprocity) to 5 (very reciprocal interaction).

6) *Mother’s mood* and *child’s mood* were also assessed using a 5-point Likert scale (one for each partner) ranging from 1 (unhappy) to 5 (happy).

7) *Adaptive/Maladaptive feeding interactions* were assessed through the *Observational Scale for Mother-Infant Interaction during Feeding* (Chatoor et al., 1997), specifically developed to rate video recordings of the mother-child interaction during children’s meal and their quality. This scale assesses normal and/or at-risk feeding interactions between mother and child (age range: 1–36 months). The Italian version (*Scala di Valutazione dell’Interazione Alimentare*, SVIA; Lucarelli et al. 2002) is composed of 41 items, divided into four subscales: Affective State of the Mother, Interactional Conflict, Food Refusal Behaviors of the Child, Affective State of the Dyad. A total monodimensional score can be derived from the sum of the four subscales scores and it was used for the purposes of the present study (Fadda & Lucarelli, 2017; Cimino et al., 2018). Indeed, it has been stated that when using the measure to discriminate adaptive from maladaptive mother–child interactions (rather than discerning feeding disorders in children), the sum of the four scores is appropriate (Chatoor et al., 1998; Cimino et al., 2018). Higher scores defined more dysfunctional dyadic interactions during feeding and Lucarelli et al. (2002) indicated a cut-off > 54 to discriminate clinical scores. In the present study, the quality of interaction was evaluated on the basis of the cut-off in adaptive vs. maladaptive feeding interactions. The Italian version of this tool (Lucarelli et al., 2002) showed a good discriminant and construct validity. In this study, the video recordings were coded by two specially trained expert coders. The codings were made independently and blindly to the characteristics of the sample. The coders had no information on the age or clinical condition of the children. In case of discordance of more than two points of the Likert scales, the sequences were revised by resolving the discrepancies with a shared agreement or with the intervention of a third observer. Reliability calculated on 20% of the video recordings showed intraclass correlations ranging from .71 and .97 for all scales considered.

*2.2.2 Assessment of maternal psychological profiles*

In addition to the coding tools described above, mothers filled in the *Symptom CheckList-90 item-Revised* (SCL-90-R; Derogatis, 1994), a self-report questionnaire composed of 90 items used for the assessment of the maternal psychological profile. The tool includes 10 primary scales (i.e. Somatization, Obsession-Compulsion, Interpersonal Sensitivity, Depression, Anxiety, Hostility, Phobic Anxiety, Paranoid Concept, Psychoticism and Sleep Disorders) and a Global Severity Index (GSI). The items of the SCL-90-R are scored on a 5-point Likert scale, from 0 (not at all) to 4 (very much): participants were asked to report how much they suffered in the previous week, for example, from headache, difficulty in remembering things, tendency to criticize others, easy crying crises, feeling scared etc. Higher scores indicate greater difficulty and greater psychological symptoms. The Prunas et al. study (2012) showed satisfactory internal consistency of the Italian version of the SCL-90-R in adolescents and adults (coefficient α = .70 - .96) with a clinical cut-off of ≥ 1 in the GSI, indicating psychopathological risk (Prunas et al. 2012). In this study alpha ranged from .72 and .84.

*2.2.3 Assessment of children’s emotional-behavioral functioning*

The Child Behavior Checklist/1,5-5 (CBCL/1,5-5; Achenbach & Rescorla, 2000; Frigerio et al., 2004) was used in the present study to assess child emotional-behavioral functioning in different areas of daily functioning. The CBCL is a report-form questionnaire filled in by mothers and it could be used with children from 18 to 60 months. The questionnaire is composed by 99 items grouped in seven empirically based syndromic scales: Emotionally Reactive, Anxious/Depressed, Withdrawn, Somatic Complaints, Sleep Problems, Attention Problems and Aggressive Behavior.

Geeraerts and coll. (2015) found that children with high scores on Anxious/Depressed, Aggressive Behavior, and Attention Problems scales (or AAA scales) had impairments in regulating affect, behavior, and cognition. Therefore, the authors underlined the importance of considering together these scales so as to have an index of the child’s Dysregulation Profile (DP). Geeraerts and coll. (2015) have verified the validity of a dysregulation profile even in preschoolers. In this study, we used the child’s DP index, with Cronbach alpha = .88.

*2.3 Data Analysis*

The hypotheses described in paragraph 1.3 were specified before the data were collected. Before performing the analyses, the variables’ normality was preliminarily ascertained. All the variables were normally distributed (absolute skewness values lower than 2 and absolute kurtosis values lower than 7; Kim, 2013). Preliminary statistical analyses have been carried out (qualitative and quantitative analyses). Descriptive statistics (reliability of the measures, frequencies, mean scores and percentages) were carried out and the absence of differences between the UW and NW groups in the demographic variables was verified.

The association between the quality of mother-toddler interaction (adaptive vs. maladaptive) and children’s weight (underweight vs normal weight) was examined using Chi-Square analysis.

Furthermore, to examine the quality of the mother-toddler interactional patterns during feeding in UW and NW groups, we carried out multivariate analyses of variances (MANOVAs) on the scales included in the *Coding Scheme for Toddler-Parent Interaction* (i.e. Global Sensitivity, Facilitations, Intrusiveness, Reciprocity, Mother’s and child’s mood). Specifically, the group (UW or NW group) and child’s sex were utilized as independent variables and the scales above were utilized as dependent variables. In all MANOVAs, univariate analyses were then conducted on significant effects. In the present sample, there was a very low rate of toddler’s request for reassurance, so they were not included in these statistical analyses.

Finally, after verifying the correlations between the measured dimensions, multiple regression analyses were conducted to investigate the association of toddler’s DP and mother’s GSI on the quality of mother-toddler feeding interactions*.* All analyses were performed with SPSS software (Version 25.0).

**3. Results**

*3.1 Group differences between UW and NW groups in adaptive vs. maladaptive mother-toddler interactions*

Chi-Square analysis showed a significant association between the quality of mother-toddler interaction (adaptive vs. maladaptive) and children’s weight (underweight vs normal weight), χ2(1, n = 150) = 123.3, p < .001). Specifically, feeding interactions between UW children and their mothers were more likely to be assessed as maladaptive compared to NW children whose interactions were more adaptive (see Table 3).

Table 3. Association between the quality of mother-toddler interaction and children’s weight

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | Adaptive interactions | Maladaptive interactions | Total |
| NW group\* | N | 74 | 3 | 77 |
| Exp. Val | 40 | 37 | 77 |
| UW group\* | N | 4 | 69 | 73 |
| Exp. Val | 38 | 35 | 73 |
| Total | N | 78 | 72 | 150 |

Note. NW group = Normal-weight group; UW group = underweight group. \* = adjusted standardized residual ≥ ±2. Adaptive and maladaptive interactions were discriminated based on SVIA cut-off.

*3.2 Group differences between UW and NW groups in the quality of mother-toddler feeding interactions*

Results from the MANOVA conducted to test differences between groups in quality of mother-toddler feeding interaction showed a significant effect of group factor (Lambda = .275; F(14, 80) = 15.05; p < .001) and no significant effect of sex; sex X group factors were also not significant.

Table 4 shows average scores of assessed aspects of mother-toddler interactions’ quality and univariate effect of analysis of variances between UW and NW groups. UW children showed less demand for autonomy, request for cooperation and other cues than NW children, but no differences were found in cues of wanting to stop the interaction. Furthermore, mothers of underweight children were less sensitive to toddler’s cues of wanting to stop the interaction and demands for autonomy compared to mothers of normal weight children. On the other hand, no group differences were found in maternal sensitivity to child’s request for cooperation and child’s other cues. Moreover, interactions between mothers and their underweight children were characterized by lower levels of maternal sensitivity, fewer facilitations, higher intrusiveness, more negative maternal and child mood and less reciprocity compared to interactions between mothers and normal weight children.

Table 4. Means, sd and F of assessed aspects of mother-toddler interactions in UW and NW groups

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | UW Group | NW Group | F | P |
| CODING SCHEME | INT | 2.34 (.99) | 2.10 (.92) | 1.72 | .192 |
| S-INT | 2.42 (.77) | 3.5 (1.12) | 33.42 | <.001 |
| AUT | 1.77 (.94) | 2.26 (.82) | 21.29 | <.001 |
| S-AUT | 2.85 (.77) | 3.55 (.85) | 23.14 | <.001 |
| COOP | .82 (.65) | 1.49 (.91) | 20.51 | <.001 |
| S-COOP | 4.28 (.64) | 4.35 (.94) | .197 | .658 |
| OTHER | 2.01 (.54) | 2.84 (.4) | 49.31 | <.001 |
| S-OTHER | 3.39 (.85) | 3.62 (.93) | 1.46 | .23 |
| Global Sensitivity | 3.00 (.83) | 3.52 (.84) | 7.89 | .006 |
| Facilitations | 2.21 (.82) | 3.79 (1.28) | 98.53 | <.001 |
| Intrusiveness | 2.70 (.81) | 3.60 (.71) | 23.93 | <.001 |
| Mother’s mood | 2.66 (.84) | 3.55 (.79) | 44.75 | <.001 |
| Child’s mood | 2.55 (.71) | 3.08 (.79) | 18.47 | <.001 |
| Reciprocity | 2.73 (.63) | 3.78 (.95) | 34.68 | <.001 |

Note. INT = toddler’s cues of wanting to interrupt interactions; S-INT = maternal sensitivity to toddler’s cues of wanting to interrupt interactions; AUT = toddler’s demand for autonomy; S-AUT = maternal sensitivity to toddler’s demand for autonomy; COOP = toddler’s request of cooperation; S-COOP = maternal sensitivity to toddler’s request of cooperation; OTHER = toddler’s other cues; S-OTHER = maternal sensitivity to toddler’s other cues.

*3.3 Association between toddler’s and mother’s individual characteristics and quality of mother-toddler feeding interactions*

To verify if the quality of mother-toddler feeding interactions was associated with toddler’s and mother’s individual characteristics, multiple linear regression analyses were conducted. Specifically, regressions analyses were carried out to test the association between child’s DP and mother’s GSI and the scales included in the *Coding Scheme for Toddler-Parent Interaction.* Results showed that lower scores of the scale *Facilitations* were associated with toddler’s more dysregulated profile (R2 = .19; ß = -.22; t = -.2.02; p < .05) and with mother’s higher scores in the GSI (R2 = .19; ß = -.25; t = -.2.23; p < .05). Furthermore, high score of toddler’s DP was associated with less maternal sensitivity to child’s cues of wanting to interrupt interactions (S-INT; R2 = .18; ß = -.34; t = -2.94; p < .01) and a worse *Mother’s Mood* (R2 = .07; ß = -.28; t = -2.4; p < .05). Table 5 shows multiple regression analyses results.

Table 5. Influence of toddler’s and mother’s individual characteristics on mother-toddler feeding interactions.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | DP | | | GSI | | |
|  | R2 | ß | T | *p* | ß | t | *p* |
| S-INT | .18 | -.34 | -2.94 | **.004** | -.11 | -.99 | .323 |
| S-AUT | .08 | -.10 | -.81 | .418 | -.20 | -1.61 | .110 |
| S-COOP | .01 | .06 | .49 | .627 | -.06 | -.44 | .662 |
| Global Sensitivity | .05 | -.14 | -1.13 | .259 | -.09 | -.78 | .439 |
| Facilitations | .19 | -.22 | -2.02 | **.045** | -.25 | -2.23 | **.027** |
| Intrusiveness | .12 | -.21 | -1.83 | .069 | -.16 | -1.40 | .163 |
| Mother’s Mood | .07 | -.28 | -2.40 | **.018** | .01 | .11 | .912 |
| Child’s Mood | .04 | -.21 | -1.75 | .082 | .02 | .21 | .836 |
| Reciprocity | .09 | -.11 | -.89 | .373 | -.22 | -1.85 | .066 |

Note. DP = Dysregulation Profile; GSI = Global Severity Index; S-INT = maternal sensitivity to toddler’s cues of wanting to interrupt interactions; S-AUT = maternal sensitivity to toddler’s demand for autonomy; S-COOP = maternal sensitivity to toddler’s request of cooperation; S-OTHER = maternal sensitivity to toddler’s other cues.

**4. Discussion**

The present study aimed to assess the quality of mother-toddler feeding interactions in a sample of underweight and normal weight toddlers. Several studies have highlighted the association between dysfunctional mother-child feeding interactions and children’s eating difficulties (Dinkevich et al., 2015; Powell et al., 2011). The current study investigated further this relationship, focusing on maternal sensitivity to a variety of toddler's cues and on the mothers’ and children’s individual factors that could be associated to lower maternal sensitivity.

In line with our first hypothesis, we found that adaptive interactions were more characteristic of mother-normal weight toddlers, while maladaptive interactions were more likely observed when toddlers were underweight. This result is in line with scientific literature (Ammaniti et al., 2010; Ammaniti, Lucarelli, Cimino, D'Olimpio, & Chatoor, 2012) and stresses the key role of the mother-toddler relationship in the child's eating difficulties.

Moreover, results showed that underweight toddlers showed lower needs for autonomy, lower request for cooperation and they generally sent fewer cues to their mothers. On the other hand, mothers showed lower sensitivity to toddler’s cues wanting to interrupt interactions and to request for autonomy, while mother’s sensitivity to child’s request for cooperation was similar in both groups. This result is very interesting because, if on the one hand our hypothesis about a lower maternal sensitivity in the group with underweight toddlers is confirmed, on the other hand toddlers in this group report their needs to their mothers less intensely and frequently. This finding could have several explanations: underweight toddlers could express fewer needs because maternal responses to their requests are often not sensitive and contingent; however, it is possible that a greater underweight toddler’s difficulty in communicating their needs makes it difficult for their mothers to understanding them, therefore resulting in lower maternal sensitivity. These hypotheses are not mutually exclusive and further longitudinal studies would be necessary to better investigate these dynamics.

Overall, in line with recent literature (Dinkevich et al. 2015; Burge, Louis, & Giardino, 2019), which has shown that maternal pressures and worries about feeding are associated with less child weight, our study found that quality of feeding interactions in the UW group was poorer than in the NW group: mothers of underweight toddlers showed lower global sensitivity, fewer facilitations, and greater intrusiveness compared to mother of normal weight children and the interactions with their children were characterized by lower reciprocity. Moreover, mothers and children of UW group had a more negative mood during feeding interaction than mothers and children of NW group, which can be seen as index of difficulties experienced by both mothers and children during feeding situations (Cimino et al., 2018).

Finally, we hypothesized that maternal sensitivity was a relational construct, and we assumed that the toddlers’ emotional-behavioral difficulties and the maternal psychopathological risk have an influence on maternal sensitivity during feeding interactions. Our results show that fewer maternal facilitations were associated with more toddler’s emotional-behavioral dysregulation and more maternal psychopathological risk. Furthermore, high score of toddler’s dysregulation were associated with lower maternal sensitivity to toddler’s cues of wanting to interrupt interactions and a lower mother’s mood assessed during the feeding situation.

In line with the literature (Feldman, 2003; Sameroff, 2010; Vallotton, Harewood, Froyen, Brophy-Herb, & Ayoub, 2016) and the hypotheses of the present study, toddler’s and mother’s individual characteristics seem to interact together in influencing the quality of the interaction. One of the factors that has been most associated with the quality of maternal interactions in both contexts is the toddler’s emotional-behavioral functioning, specifically the dysregulation profile: more dysregulated children seem to have less sensitive mothers to the child's attempts to interrupt the interaction, who do not facilitate the autonomy of the child. We can assume that these mothers tend to have more control in the face of dysregulation of the child. This result is in line with recent studies in the field of epigenetics (Anacker, O'Donnell, & Meaney, 2014; Cimino et al., 2018; Cimino et al., 2019; Harper, 2005), which show that child’s genetic temperamental factors may be modified by increased parental stress which does not help children to find a state of calm and support their learning to regulate emotions.

On the other hand, this result is also linked to a limitation of the present study. The use of report form questionnaire for the evaluation of the toddler’s emotional-behavioral functioning does not allow to have a more objective view: subjective maternal perspective and her relationship with the child could have influenced the responses to the questionnaire. Future studies might rely on reports on child functioning from other respondents (e.g. fathers, other caregivers, nursery staff, etc.) or on direct observation of child behaviors in different contexts. Furthermore, as highlighted above, the identified associations do not indicate the direction of these associations. It is possible that underweight status of the child may contribute to maladaptive interactions and vice versa. Moreover, although positive associations were found, the variance explained is low. Further studies (especially longitudinal studies) could use real-time behavior observations, that offer more advanced ways of measuring parent-infant synchronization, shining more light on the direction and strength of these highlighted dynamics.   
Another limitation concerns the lack of data on father-child feeding interactions which does not allow a complete overview of toddler’s interactional patterns. In fact, this study focused on mother-toddler interactions, emphasizing the maternal role in the transition from dependence on the mothers to greater autonomy and independence in nutrition. On the other hand, the paternal role in supporting the children's demand for autonomy is known in older children (Belsky et al., 2008) or in play contexts (Hughes, Lindberg, & Devine, 2018), and it would be very interesting to observe differences between the roles of maternal and paternal sensitivity to the toddlers’ cues in feeding context.

Nevertheless, this study has several strengths: the use of observational tools allowed to assess in a reliable way and independently from maternal reports the quality of interactions. Moreover, such assessment included not only overall adaptive/maladaptive quality of mother-child feeding interactions on different dimensions, but also maternal sensitivity to toddler’s specific cues which might be particularly relevant in the feeding context. This is particularly important because it might help to detect some specific dysfunctional interactive patterns and allow the implementation of specific prevention and treatment programs. Finally, the inclusion of individual and relational variables in the present study allowed a more comprehensive understanding of the dynamics that may favor or hinder toddlers’ eating patterns, in this developmental age, characterized by the development of the autonomous self (Ammaniti et al., 2010; Feldman, 2007; Stern, 1985). Indeed, the results of this study may contribute to an understanding of the dynamics that can arise in this specific age group, which involves an evolutionary change in the mother-child dyad. As such, this period represents a time of risk, for which it is important to be able to prevent the onset of possible disorders.

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**Author Contributions**

All authors provided critical review and commentary on the draft manuscript, and approved the final manuscript.

**Data availability**

The raw data that support the findings of this study are available from the corresponding author upon reasonable request.

**Declaration of competing interest**

None.

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