

# Improvements in mealtime behaviors of children with special needs following a day-center-based behavioral intervention for feeding problems

## *Gestione dei problemi alimentari in bambini con disturbi dello sviluppo: primi risultati di un intervento comportamentale diurno intensivo*

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**SUMMARY. Aim.** Feeding problems are documented in several developmental disabilities. This paper aims to present early results from the implementation of a day-center, multidisciplinary, intensive, behaviorally-based treatment package for feeding problems, delivered to children with developmental disabilities, namely Autism Spectrum Disorder (ASD) and Intellectual Disability (ID). **Methods.** This is a quasi-experimental design study. Both an AB design (measures were administered at pre- and post-treatment times) and a comparison design were used; a follow-up was carried out after one year from the end of the treatment. A total of 18 children, 8 with ASD and 10 with ID, were included in the study. Body weight, count of food types and textures accepted, length of the meal, count of problem behaviour topographies, count of individuals with proper chewing and BAMBI-18 scores were the measures chosen to check the effectiveness of the treatment. **Results.** Statistically significant differences between pre-, post-treatment and follow-up were found, with decreased problem behavior during meals and increased body weight, effective chewing and food variety (type and texture). **Conclusions.** Despite its relatively short duration, this treatment package appeared to be effective in improving behaviors at mealtime in both children with ASD and ID; if confirmed by future studies, the program could represent an interesting model for treating feeding problems in children with special needs, because it is implemented in a day service (with lower costs compared to residential or hospital services), takes advantage from family co-therapy, and can be integrated in a global psychoeducational program.

**KEY WORDS:** feeding problems, mealtime behaviors, behavioral intervention, feeding treatment, autism, intellectual disability.

**RIASSUNTO. Scopo.** I problemi alimentari sono documentati in diversi disturbi dello sviluppo. Questo studio si propone di presentare i primi risultati dell'implementazione di un pacchetto di trattamento comportamentale, multidisciplinare e intensivo per i problemi alimentari, in bambini con disturbo dello spettro dell'autismo (ASD) e disabilità intellettiva (ID). **Metodo.** Il presente studio, quasi sperimentale, ha utilizzato sia un disegno AB sia un confronto fra i due gruppi; inoltre, è stato effettuato un follow-up dopo un anno dalla fine del trattamento. È stato incluso nello studio un campione di 18 bambini, di cui 8 con ASD e 10 con ID. Per verificare gli effetti del trattamento, sono state scelte le seguenti misure: peso corporeo, conteggio del numero di alimenti e consistenze accettate, durata del pasto, conteggio delle topografie comportamentali inadeguate, conteggio dei bambini con masticazione valida e punteggi al BAMBI-18. **Risultati.** Sono state trovate differenze statisticamente significative tra pre-, post-trattamento e follow-up, con diminuzione dei comportamenti problematici durante i pasti, aumento del peso corporeo, miglioramento della masticazione e aumento della varietà di cibi e consistenze assunte. **Conclusioni.** Nonostante la relativa brevità, questo protocollo di trattamento sembra essere efficace nel migliorare i comportamenti durante i pasti in bambini con ASD e ID; se confermato da studi futuri, il programma potrebbe rappresentare un modello interessante per trattare i problemi di alimentazione nei bambini con disturbi dello sviluppo, perché esso può essere implementato in un servizio diurno (con costi inferiori rispetto ai servizi residenziali o ospedalieri), e inserito in un trattamento psicoeducativo globale con l'adozione della co-terapia familiare.

**PAROLE CHIAVE:** problemi alimentari, comportamento alimentare, intervento comportamentale, trattamento alimentare, autismo, disabilità intellettiva.

## INTRODUCTION

Children with special needs frequently experience feeding problems, which have a relevant impact on development and health.

We eat because we are hungry, or because we enjoy the taste of food, or because we enjoy to be part of a social event; on the contrary, many children with atypical development may have little appetite, suffer from medical problems (e.g., constipation or gastroesophageal reflux), show oral-motor problems (e.g., cerebral palsy, dysphagia), and anatomical abnormalities (e.g., cleft-lip and palate)<sup>1,2</sup>; however, involuntary reinforcement of undesirable behaviors at mealtime: may also trigger feeding problems (when children refuse food, parents tend either to stop feeding them or replace non preferred food with favorite one)<sup>2</sup>.

The term "feeding problems" typically refers to oral consumption of nutrients that deviates from the norm, enough to lead to negative social or health consequences. They vary by etiology, behavioral topography, and severity<sup>2</sup>. With regard to the etiology of pediatric feeding problems, Burklow et al.<sup>3,4</sup> developed a classification system, by examining the multiple factors involved, thus overcoming the organic-nonorganic dichotomy. The following categories were taken into consideration: structural abnormalities; neurological conditions; behavioral issues; cardiorespiratory problems; metabolic dysfunction. Thirty-eight percent of the study sample (n. 103) had a history of prematurity, and a diagnosis of developmental delay had been made in 74% of cases; results showed, in the majority of children, a behavioral component for feeding problems: the most frequent combinations of categories coded were structural-neurological-behavioral (30%), neurological-behavioral (27%), behavioral (12%), structural-behavioral (9%), and structural-neurological (8%); furthermore, behavioral issues were coded more often (85%) than neurological conditions (73%), structural abnormalities (57%), cardiorespiratory problems (7%), or metabolic dysfunction (5%); authors suggested that feeding problems are biobehavioral conditions, in which biological and behavioral aspects mutually interact.

A more recent form of classification was based on the functions of specific feeding behaviours: feeding problems are considered either motivationally or skill based<sup>5</sup>. Motivationally based problems are those maintained by the caregivers's responses and can include, for example, refusal to eat or refusal of certain food or textures: attentioning these behaviors plays an important role in the maintenance of the problem; instead, skill-based problems refer to the difficulty or impossibility to eat, because the child does not have the necessary skills (such as sucking, chewing or swallowing). Defining the topographies and functions of the child specific feeding behaviors could be extremely useful in planning the treatment.

Feeding problems are documented in several developmental disabilities, among them the Autism Spectrum Disorder (ASD)<sup>6</sup> and the Intellectual Disability (ID)<sup>7</sup>. Not only are feeding problems more prevalent among individuals with developmental disabilities, but they are also more severe and persistent over time<sup>8</sup>.

The prevalence of feeding problems in children with ASD is estimated at around 90%<sup>9</sup>, 70% of which showing food selectivity<sup>10</sup>. Over 80% of people with ID have some feeding

difficulties<sup>11,12</sup>, the most prevalent falling within feeding skills (including inability to feed him/herself independently, requiring special equipment for feeding, and requiring special positioning during feeding), but also food refusal, food selectivity, and nutrition-related behavior problems.

Medical and environmental etiology<sup>5,13</sup> were described for both children with ASD and ID; to this regard, Field et al.<sup>5</sup> analyzed predisposing factors for eating problems, including gastrointestinal, cardiopulmonary, neurological problems, renal disease and anatomical anomalies, in three different developmental disabilities (autism, Down syndrome and cerebral palsy). Gastroesophageal reflux was the most prevalent medical condition found in the sample children and was associated with food refusal; instead, neurological conditions and anatomical anomalies (such as oral motor delays and dysphagia) were associated with skill deficits.

Among the environmental etiologies, inappropriate parental feeding practices were included: in fact, feeding problems, even in the case of organic origin, tend to be maintained due to reinforcement, especially the negative reinforcement (escape from the situation), which has been assumed as being the main factor for maintaining children's undesirable mealtime behaviors<sup>13-16</sup>. Communication and social skills deficits (e.g., children not asking for food) as well as idiosyncratic focus on details, behavioral rigidity, and sensory impairments were also included<sup>17</sup> among the environmental etiological factors.

Behavioral problems most frequently associated with mealtime are low independence, food refusal (e.g., crying, head turning, spitting, throwing utensils, keeping food in mouth, aggression, and standing up), coughing/gagging, food selectivity, texture-related problems, rumination, pica, and vomiting<sup>2,18-20</sup>. In the study by Field et al.<sup>5</sup>, with regard to behavior topographies, children with autism showed selectivity by type (in 62% of the sample) and texture (31%), children with Down syndrome showed oral motor delay (82%) and selectivity by texture (45%), while children with cerebral palsy showed oral-motor delay (68%), dysphagia (14%) and food refusal (13%).

A study by Williams et al.<sup>21</sup> examined feeding problems in 178 children, divided into three groups: children with ASD, children with special needs without autism, and children with typical development; some differences were found between groups: children with ASD insisted in using always the same utensil or dish, or in having food prepared in a certain way; children with special needs showed significant problems with spitting out food and oral motor delays; and finally, children with typical development presented with anxiety or obsessive-compulsive behaviors.

Chronic feeding problems put children at risk for malnutrition, growth and developmental delay, invasive medical procedures (e.g., placement of a feeding tube), psychological and social deficits<sup>22,23</sup>. With regard to the dietary intake of children with ASD, results from the literature studies appear to be conflicting; some authors have reported similar intake in both children with ASD and controls, some others poor intake, especially for micronutrients<sup>24</sup>. Recent studies suggested significantly lower intake of calcium and protein, iron vitamin B5, vitamin C, folate, iodine, sodium and total energy intake in children with ASD<sup>23-25</sup>, nevertheless, the nutrient intake investigation remains an open field, as well as open questions remain with regard to the comparison between nu-

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trient intake and dietary standards, and the role played by both food selectivity and parental dietary restrictions (e.g., gluten-free or casein-free diets).

Studies on treatment of feeding problems have focused mainly on two aspects: increasing child willingness to taste new food and reducing inappropriate behaviors during mealtime.

Effectiveness of behavioral analytic procedures has been demonstrated<sup>9,26-27</sup> in pediatric and clinical (e.g., autism and ID) populations<sup>28</sup>, as well as in the case of tube-dependent children<sup>29</sup> and children with cerebral palsy<sup>30</sup>. A review by Sharp et al.<sup>22</sup> analyzed 40 studies: 43.8% of treatments were implemented in an inpatient setting, 29.3% at home/school, 16.7% in day-treatment, 10.4% in outpatient setting; in 81.3% of cases, primary therapists were trained therapists, while parents served as primary therapists in 18.8% of cases.

Behavioral analytic procedures, mostly described in case-studies, include physical guidance and escape extinction<sup>31</sup>, differential reinforcement<sup>32</sup>, differential reinforcement with escape extinction<sup>15</sup>, escape extinction with positive reinforcement<sup>33,34</sup>, non-contingent reinforcement<sup>35</sup>, the high probability sequence<sup>36</sup>, simultaneous presentation of preferred and non-preferred food<sup>37</sup>, redistribution<sup>38</sup> and textural manipulation<sup>20</sup>. Extinction, differential reinforcement, antecedent manipulation and fading are among the most frequently used behaviorally based procedures, generally implemented in inpatient settings<sup>22</sup>.

Studies as mentioned above are focused on describing the effectiveness of one or more combined behavioral techniques, tapping on a specific food problem; procedures followed by therapists are usually implemented in a highly-controlled setting<sup>22,28</sup>; the role of parents is often not-so-well specified; individual goals are measured as the amount of grams consumed, count of accepted bites, number of food expulsion, and so on<sup>20</sup>. Some other case-studies examined the effectiveness of behavioral analytic feeding treatments implemented in natural settings. For example, in a home-based parent training, focusing attention on the appropriate behavior, ignoring disruptive behaviors and saying "No" to expulsions or attempts to leave, proved to be effective in increasing food acceptance in three children with developmental delay<sup>39</sup>. Gutentag and Hammer<sup>40</sup> used differential reinforcement combined with extinction at home and at school with a tube-dependent, 3-year-old girl with food aversion: oral acceptance of food increased, thus demonstrating the effectiveness of interventions trained by parents and teachers in a natural setting. Najdowski et al.<sup>41</sup> demonstrated increases in food consumption as well as generalization and maintenance, using a food selectivity treatment implemented by parents of a child with autism, with only little supervision. Another study regarding three children with autism (multiple baseline design across participants) used parents and ABA tutors as therapists<sup>42</sup>, interventions were delivered at children's home in a highly structured way, and included escape extinction combined with non-contingent negative reinforcement: results showed increased food acceptance and decreased disruptive behavior; gains were maintained at follow-up.

All these studies have been very useful in determining the effectiveness of certain behavioral procedures; however, experimental conditions, also when implemented in a natural setting, may be often too far from everyday life. Therefore, there is a strong need to adopt integrated programs, in which

parental role might be clearly established, in order to ensure a successful intervention in real daily life. In order to address this point, Linscheid<sup>20</sup> introduced a model of an inpatient treatment facilitating success during the transition of the program delivery from hospital to home; treatment was carried out 7 days a week by psychologists trained in behavioral principles and procedures. A few other intensive, interdisciplinary, behaviorally-based treatments have been described in the literature: for example, Cohen et al.<sup>43</sup> reported increases in food variety and texture, and self-feeding skills as well as decreases in bottle dependence and inappropriate mealtime behaviors after a day-treatment program for children with developmental disabilities and feeding problems. Seiverling et al.<sup>44</sup> found improvements in children mealtime behavior, as well as in the overall family mealtime environment, in a sample of 50 children (with and without special needs), before and after an outpatient intensive behavioral feeding program, in which each child received a 45-min intervention session per day, over a period ranging from 2 to 8 weeks. Positive outcomes were also described in children with tube-dependence, participating to an intensive interdisciplinary day-treatment program<sup>2,45</sup>. Sharp et al.<sup>46</sup> examined nutritional status, mealtime performance (acceptance, swallowing) and disruptive mealtime behaviors in a group of children with ASD, before and after an intensive day-treatment feeding program which included escape extinction, reinforcement, and stimulus fading procedures. Significant improvements in mealtime performance, variety of food and food categories consumed, as well as decreased inappropriate mealtime behaviors were found. This program was carried out for 8 weeks by trained therapists, while parents were involved within the treatment about 3 weeks before discharge; gains turned out to be maintained at follow-up (17 months after discharge). Douglas and Harris<sup>47</sup> described positive results (e.g., weight gain, increases in food and drink intake and food textures, decreases in undesirable behaviors during meals) obtained after a day-center-based feeding program attended by children's families once every other week, for a maximum of 12 treatment sessions. Finally, Sharp et al.<sup>48</sup> described the Autism MEAL Plan, a behaviorally based parent-training curriculum, including eight didactic, 1h-long, group sessions; results were indicative of how parents perceived program effectiveness, and showed reduced levels of caregiver stress, thus proving the highly social validity of the program; however, no significant changes in feeding behaviors were found, hence, the need for introducing some training modifications, such as, supplemental learning activities (e.g., role-playing, video examples, and in vivo coaching).

A final aspect to be taken into consideration is the role of food in interpersonal relationships, especially within the family and the school context, and its impact on the quality of family life and parents stress. Food is our first contact with the world, and the feeding function, since breastfeeding, is intertwined with relational and affective dimensions; this relational meaning of food is maintained over time, and extends from parents to the family context and then to school. When children refuse food, parents may feel as being rejected by their own children or may see the behavior as being hostile towards them. The level of parental stress in families of children with autism is significantly higher than families of children with other developmental disabilities or typical development<sup>49-51</sup> and it is related to features like behavioral and emo-

tional problems, irritability, poor daily living and communication skills as well as poor cognitive abilities; the presence of feeding problems further worsens stress levels, profoundly affecting the well-being and quality of life of the entire family: mealtimes, therefore, become a source of stress rather than enjoyment<sup>52</sup>, and families tend also to isolate themselves from the social context and avoid mealtime socialization experiences. Strategies aimed at the early management of eating problems thus become crucial in limiting the levels of parental stress, fostering better parent-child relationships, and guaranteeing a life as much normal as possible.

It is clear, now, that early addressing feeding problems is extremely important for many reasons (ensuring a balanced diet, facilitating family life, providing opportunities for developing social relationships at mealtimes or snacks, eliciting others skills, in particular language and motor skills, decreasing undesirable behaviors such as rigidity and insistence on sameness)<sup>1</sup>, and that varied diet and adequate food intake are essential for children's physical health and development; nevertheless, and unfortunately, in our Region, there are very few services and teams systematically addressing feeding problems of children with developmental disorders. Thus, this paper aims to present early results from a daily behavioral treatment package for feeding problems with two small groups of children with developmental disabilities, namely ASD and ID; this program is an alternative to inpatient treatments and it is delivered in a day-time psychoeducational private clinical setting; difficulties in treating children at home have been taken into consideration, by introducing a co-therapy training for parents, and a guideline for the application of the Applied Behavior Analysis (ABA) procedures. We expected to obtain significant improvements in feeding behaviors at the end of the treatment period in both groups; additionally, we expected gains obtained from the program to be maintained at the follow-up.

## METHODS

### Study design

This is a quasi-experimental design study; effectiveness of the behavioral treatment package for feeding problems was evaluated in two small groups of children, with ASD and ID respectively; both an AB design (measures were administered at pre- and post-treatment) and a comparison design were used. Each child was then followed-up at one year from the end of treatment. Treatment characteristics are described in the Procedures session.

### Participants

A total of 18 children, 8 with ASD and 10 with ID, were included in the study; they were assigned to treatment consecutively, based on their ranking in the waiting-list of the relevant clinical service.

Characteristics of the sample, namely chronological ages, developmental ages (as obtained from the Psychoeducational Profile Third edition - PEP-3)<sup>53</sup>, chewing, oral-motor movements, and scores > cut-off on Brief Autism Mealtime Behaviors Inventory (BAMBI-18)<sup>54</sup> are shown in Table 1.

The onset of feeding problems in children with ASD ranged from 6 months to 9 years (median: 15.5 months; interquartile range 8.25-31.5), while in children with ID from 6 months to 6.5 years (median: 17 months; interquartile range: 8-46.25).

All participants were diagnosed by a multidisciplinary team of professionals, using the DSM-5 criteria<sup>55</sup>; for children with ASD, diagnoses were further confirmed using at least one of the most common diagnostic scales: the Autism Diagnostic Interview-Revised, the Autism Diagnostic Observation Schedules or the Childhood Autism Rating Scale-Second edition.

## Measures

In order to establish the effectiveness of the treatment, the following measures were used at pre- and post-treatment; the BAMBI-18 was also used at follow-ups:

- body weight;
- count of food type accepted, as a measure of increased variety;
- count of textures accepted (liquid, puree, semisolid and solid);
- length of meal;
- count of problem behavior topographies during mealtime;
- count of individuals with effective chewing;
- BAMBI-18 scores. It is a 18-item interview to evaluate mealtime behavior problems; caregiver is asked to indicate how often the child engages in a particular eating behavior. A 5-point Likert scale is used, with response options ranging from 1= never to 5= always, including a neutral midpoint; a total frequency score is derived from the sum of the items, including reversed scores, with higher scores indicating more problematic mealtime behaviors; undesirable behaviors can be analyzed also on the basis of four main factors, and namely: food selectivity, disruptive mealtime behaviors, food refusal and mealtime rigidity;
- count of individuals with BAMBI-18 scores above the cut-off =34.

## Statistics

Most of the variables analyzed in this study did not show a normal distribution (asymmetry and kurtosis calculations), thus non-parametric statistics were used. The intra-group comparisons were carried out using the Wilcoxon test for paired data sets (pre- and post-treatment assessments); the significance level was set as  $p < 0.05$ . The between-group comparisons were carried out by means of the Mann-Whitney's  $U$  test; the significance level was set as  $p < 0.05$ . Effect sizes were calculated by means of Cliff's *delta* (the absolute value can be considered as small around 0.147, medium around 0.33, and large around 0.474). Finally, the Chi-square test was used for frequency data.

## Procedures

### Feeding intervention characteristics

There are two main issues that hinder the development of standard treatment protocols for feeding problems: first, the non-homogeneity of feeding problems presentation in children, and second, the goals that change with the progressing of treatment. For this reason, program specifications reported ahead are to be considered as guidelines; indeed, treatment plans were individual-

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Table 1. Sample characteristics. Data are expressed as median (interquartile range) unless otherwise specified.

	ASD	ID	ASD and ID comparison
			Chi-square test
n (M/F)	8 (7/1) <sup>a</sup>	10 (8/2) <sup>b</sup>	ns
Atypical oral-motor movements, n	2	5	ns
Effective chewing, n	3	4	ns
			Mann Whitney test
Developmental age in months, median (interquartile range) <sup>c</sup>	20 (11/20.15)	29 (24/36)	0.009
Chronological age in years, median (interquartile range)	3.7 (2.77/4.7)	4 (3.5/6.03)	ns
BAMBI-18 > cut-off, n	8	10	

*Legend:* ASD: Autism Spectrum Disorder; ID: Intellectual Disability. <sup>a</sup>1 liquid-dependent and 1 with lactose intolerance. <sup>b</sup>1 tube-dependent, 1 with lactose intolerance, 4 with gastroesophageal reflux. <sup>c</sup> As obtained from PEP-3.

ized and procedures were implemented with flexibility, in order to take into account the specific characteristics of each child and his/her response to treatment.

Our feeding intervention program was carried out for about 10 weeks in a private daily clinical setting; three meals a day were included (breakfast, lunch, snack time): the maximum duration of the lunch was established at 30 minutes, while breakfast and snack time at 10-15 minutes (longer mealtimes, indeed, seem to reinforce the perception that feeding is an unpleasant and stressful activity and do not ensure the child to be hungry at the next meal); dinner was fed by parents, according to staff instructions. Co-therapy with parents is a fundamental part of our protocol; indeed, therapists guide parents on how to manage the mealtime and control child inappropriate behaviors. As stated by Mueller et al.<sup>56</sup>, most children with feeding problems have the majority of their meals at home, therefore, it is extremely important to have parents become able to apply treatment procedures in an accurate and consistent manner; authors suggested that effective training should consist of at least two components to ensure high treatment accuracy. Co-therapy in our intervention included three main components, and namely verbal instructions, modeling and prompted procedure implementation, in the following order: explanation and sharing of the feeding program; verbal instructions for the dinner meal (this latter only slightly differing from the usual one in the initial phases); video-observations of the treatment (at the beginning of the program, parents are not present, due to the fact that they could represent a discriminative stimulus for behaviors counterproductive to treatment goals); direct observation of the procedure execution by therapists during meals in later stages; direct management of the mealtime, prompted by therapists.

Contingency management techniques include manipulation of both antecedent and consequent variables<sup>1,20</sup>. Most of research studies emphasize the importance of motivating children to respond to educator instructions<sup>57</sup>. Given the tendency of children with special needs, in particular those with autism, to engage in highly-frequent escape and avoidance behaviors, intervention methods that increase motivation to comply may be essential in producing positive outcomes. For this reason, antecedent variables manipulation was used and feeding intervention was included within a psycho-educational, behaviorally-based program, provided every day, for about 6 hours a day, with a 1:1 educator-child ratio; this choice was aimed first to prevent children from identi-

fying the educators and the environment as being aversive stimuli (while working only on nutrition), and second, to encourage acceptance of the therapist and, consequently, obtain greater collaboration at mealtime. Another antecedent variable taken into account was the appetite manipulation through reduction of calories intake between meals (offering water or tisanes without calories); this would ensure children to be hungry enough at meals. Finally, the use of adaptive equipment (for example, spoon with built-up handles, dishes with sides, cups with handles or special sippy-lid cups) whenever necessary.

Manipulation of consequence variables refers to manipulation of individualized positive reinforcements, such as access to preferred toys or videos or other tangible non-food rewards, or access to preferred food to increase the consumption of new food; reinforcer is immediately provided whenever child shows the desirable behavior.

Whenever undesirable behaviors take place, such as crying, turning the head away, pushing the spoon away, or tighten the mouth, some behavioral procedures can be used: for example, when the child spits out food, the preferred antecedent procedure to be used is the reduction of the bite size, while the consequent procedure is the re-presentation of the bite; when the child keeps food in his/her mouth and refuses to swallow, the bite size/texture can be reduced; alternately, sips of drinks or preferred low-texture food can be provided; in addition, the bolus can be moved in the mouth to facilitate swallowing propulsion phase. Whenever the child tends to keep his/her mouth tight close, a negative reinforcement-based procedure is appropriate, namely the contingency contacting (or escape-extinction): the therapist holds the spoon at the child's lips until he/she opens his/her mouth and food is accepted (escape from the aversive situation occurs when the food is accepted!).

For the introduction of new food, individual plan includes one or more of the following antecedent procedures<sup>1,58</sup>: reintroducing food that the child used to prefer; mixing preferred and new food, and then gradually reducing preferred food while increasing the new; matching preferred and new food on the same spoon (for example, a tiny piece of vegetable behind a large piece of burger; or a small amount of cheese on crackers, and so on); introducing a single bite of new food (in a separate plate or in the same dish as that of the favorite food), followed by the consumption of favorite food (reinforcement), and then gradually increasing the size and the number of the new food bites.

During the training with our groups, logopedic techniques were also used, for the treatment of oromotor physical structures (intra and extra-oral sensitivity; tongue or orofacial praxis and oral movements) in order to facilitate appropriate movement of the tongue and muscles around the oral cavity, thus enabling chewing and swallowing.

Our feeding training included pre-treatment and treatment phases.

The pre-treatment phase consisted of: an Initial Evaluation Form (adapted from Williams and Foxx)<sup>1</sup>, including biographical data, nutrition information, medical data, adaptive skills, and a list of preferred items; a food inventory sheet (adapted from Williams and Foxx)<sup>1</sup>; the BAMBI-18; logopedic evaluation; a food diary to be filled in by parents over at least 5 days, and video recording of the main mealtimes for at least 3 days; the analysis of food diaries and videos by the team members, and hypotheses about the function of children's behavioral problems at meals (Escape/Avoidance? Social Attention? Tangible rewards?); a data summary sheet including number of food and textures intaken, length of mealtime, and number of behavioral problems during meals; definition of the feeding individual program.

As far as the treatment phase is concerned, the following procedures were applied: environmental adaptation (higher chairs or smaller tables, adaptive equipment, reinforcing items); implementation of the food program, using the procedures as described above and introducing new food (re-introducing food that the child used to prefer and now refuses; introduction of new food with similar texture; introduction of new food with varying texture); collection of data using the trial-by-trial data sheet (adapted from Williams and Foxx)<sup>1</sup>; systematic supervisions by the senior speech therapist.

Ethics approval was obtained from the Local Ethics Committee "Comitato Etico IRCCS Sicilia - Oasi Maria SS." (Ref. No. CE-17-06-2013-OASI). Informed consent was obtained by all parents prior to the onset of the treatment.

### Staff

Feeding intervention was carried out by a multidisciplinary team. University Degrees for all professionals were required, as well as specific education and training on autism and intellectual disability, a master degree in ABA and a specific training on structured education. The team was made of:

- a senior speech therapist, who was responsible for the overall coordination of the feeding program and the implementation of logopedic techniques;
- a nutritionist, for the dietary balance;
- a psychologist-psychotherapist, for parent psychological support, guidance for therapists and parents on the educational management and the ABA procedures application, and for easing communication between team members;
- therapists for the conduction of the feeding treatment.

## RESULTS

No statistically significant differences were found between the two groups of children at baseline, neither in number of males and females, nor in chronological ages, atypical oral-motor motility, effective chewing, and number of children with BAMBI-18 scores above the cut-off (Table 1); the analysis of BAMBI-18 sub-domains showed food selectivity as being the principal characteristic of children feeding be-

havior in both groups at baseline (scores reached 82% of total score); children with ASD also showed important rigidity (scores reaching 73% of the total score), whereas in children with ID this feature was less marked (scores reaching 43% of the total score); disruptive behaviors and food refusal ranged from 50% to 60% of the total scores in both groups. Despite some differences between the two groups in mealtime rigidity raw scores, no statistically significant difference was found at baseline in all BAMBI-18 sub-domains. The only statistically significant difference found at the baseline was in developmental ages (Table 1).

With regard to the feeding treatment outcomes, results obtained are shown in Table 2.

The intra-group comparison by Wilcoxon test showed statistically significant differences between pre- and post-treatments for both ASD and ID groups in all the measures taken into account. All children, either with ASD or ID, showed great improvements in food intake and texture variety, body weight, problem behaviors during meals, and BAMBI-18 scores (both total and sub-domains scores). The number of children with BAMBI-18 scores above the cut-off decreased significantly ( $p < 0.01$  at Chi square test). The number of children with effective chewing increased, though it did not reach the statistical significance. In both groups, no difference was found in length of meals.

At follow-up (one year after the end of the feeding treatment), BAMBI-18 raw scores turned out to be increased in both groups when comparing them to the post-treatment scores, thus indicating increased mealtime problem behaviors (Figure 1); however, in both groups the difference between baseline and follow-up remained statistically significant; additionally, in the group with ID the difference between post-treatment and follow-up was not statistically significant. On the contrary, in the group with ASD, the comparison between post-treatment and follow-up showed a statistically significant difference.

No statistically significant differences were found in treatment outcomes when comparing the two groups, neither at post-treatment nor at follow-up.

## DISCUSSION

A high percentage of children with special needs, including children with ASD and ID, show severe feeding problems, often due to organic causes as well as to a series of behavioral contingencies; they can be a major source of frustration for parents and professionals. Children often resist to trying any food that is not present in their current diet, and show selectivity and extreme emotional reactions to new food, due to type, texture, temperature, color, brand, appearance. Food selectivity was greater represented also in our sample, in both ASD and ID groups; children with ASD also showed marked rigidity, according to the literature<sup>6,17,58-64</sup> reporting a strong insistence on sameness and a resistance to change.

Remediation of feeding problems is an urgent concern for professionals and families, in order to help children and families to live a normal life as much as possible; if not adequately addressed, feeding disorders may adversely affect a child's overall health and social development and contribute to caregiver emotional distress and depression.

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Table 2. Results obtained from the comparison between the differences from pre- to post-treatment in the two groups of children. Data are expressed as median (interquartile range) unless otherwise specified.

	ASD	ID	Mann-Whitney test
	n= 8	n=10	p≤
Food intaken	40.5 (30/48.5) <sup>b,c</sup>	37 (24/54) <sup>b,d</sup>	ns
Textures (liquid, puree, semisolid, and solid)	1.5 (1/2) <sup>b,c</sup>	2 (1.25/2) <sup>b,d</sup>	ns
Body weight, gr	750 (675/1950) <sup>b,c</sup>	800 (125/1225) <sup>b,d</sup>	ns
Duration of meals, in minutes	-1 (-8.75/5)	-2 (-6.25/0.25)	ns
Behavioral problems topographies during mealtime <sup>a</sup>	-3 (-4/-2) <sup>b,c</sup>	-3 (-3.75/-4) <sup>b,d</sup>	ns
BAMBI-18 total scores	-26.5 (-29/-24.75) <sup>b,c</sup>	-20 (-26.25/-18) <sup>b,d</sup>	ns
BAMBI-18 food selectivity scores	-7.5 (-11 / -7) <sup>b,c</sup>	-7.5 (-11 / -7) <sup>b,d</sup>	ns
BAMBI-18 disruptive mealtime behaviors scores	-7.5 (-9 / -6.5) <sup>b,c</sup>	-6.5 (-9.25 / -6) <sup>b,d</sup>	ns
BAMBI-18 food refusals scores	-3 (-4.5 / -2) <sup>b,c</sup>	-2 (-3 / -2) <sup>b,d</sup>	ns
BAMBI-18 mealtime rigidity scores	-5.5 (-6.25 / -3.75) <sup>b,c</sup>	-2 (-4.25 / -1) <sup>b,d</sup>	ns
BAMBI-18 > cut-off, n	-6 <sup>e</sup>	-7 <sup>e</sup>	
Effective chewing, n	+3	+4	

Legend: ASD: Autism Spectrum Disorder; ID: Intellectual Disability. <sup>a</sup>The whole list of topographies registered at pre-treatment included: tears, spit, tighten the mouth, reject food by the hand, hold the bite in the mouth, turn head away from food, verbal aggression, physical aggression, vomiting, shouting. <sup>b</sup>p<0.05 at the Wilcoxon test from the intra-group comparison (paired datasets). <sup>c</sup>Small effect size at Cliff's *d* test. <sup>d</sup>Medium effect size at Cliff's *d* test. <sup>e</sup>p<0.01 at Chi-square test.

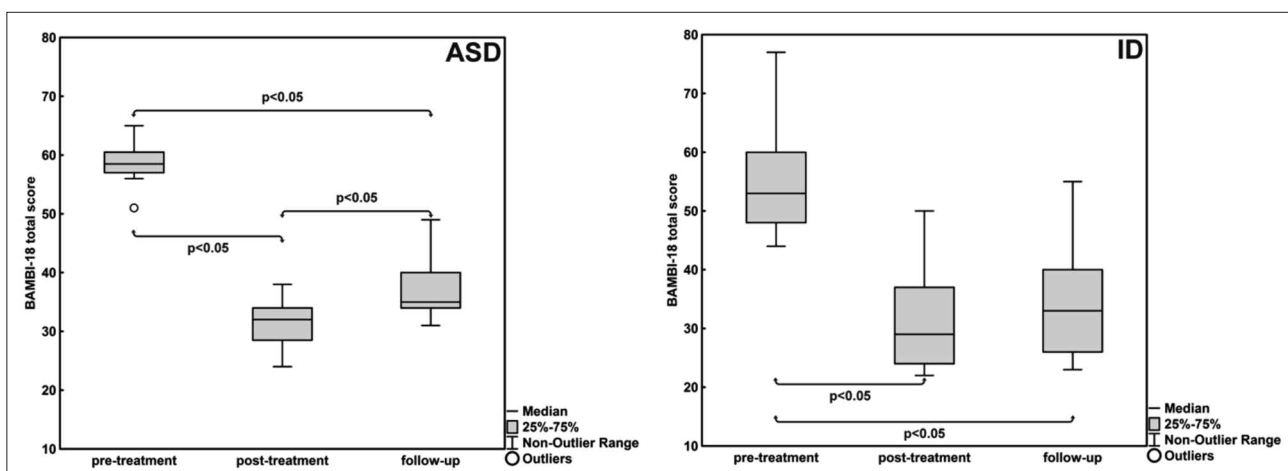


Figure 1. BAMBI-18 scores at pre-, post-treatment and follow-up in ASD and ID groups.

Behavioral interventions are frequently cited as empirically supported treatments for feeding difficulties in young children<sup>8,45,65</sup>; however, the application of behavioral procedures in the real world is often more complex and difficult than in structured and controlled settings<sup>20</sup>.

This paper aimed to present early results from a day-center-based behavioral treatment package tapping on feeding

problems in children with special needs; this intervention aimed to induce positive changes in children's eating habits, with the additional advantage of a close collaboration with parents; parents benefited from regular guidance and supervision by professionals, in order to get familiar with the use of some behavioral procedures, and continue the treatment at home.

Our sample was made of children with ASD and children with ID; results thus obtained showed important positive changes, with decreased problem behaviors during meals and increased food variety (type and texture), body weight and effective chewing. Despite its relatively short duration, this treatment package appeared to be effective in improving behaviors at mealtime of children with both ASD and ID; no statistically significant differences were found in the comparison between the two groups at post-treatment, probably due to the use of behavioral procedures, which can be considered as being effective in children with or without developmental disabilities.

At baseline, the two groups showed a statistically significant difference in developmental ages, which does not seem though to have affected the treatment outcomes; it can be assumed that developmental age is not a variable facilitating or hindering the efficacy of a feeding program in children with special needs, even though this hypothesis needs to be verified throughout correlation studies.

Our intervention is a comprehensive behavioral package, therefore it is difficult to detect which elements are more effective than others, or which component of the program entailed a specific result; however, we believe that the program has some strengths: it is delivered on a continuous basis over the week; the professional staff consist of a multidisciplinary team, that facilitate the thorough analysis of the issues; families are involved from the very beginning (with increasing engagement and responsibility), thus ensuring the consistency of program delivery both during (at evenings or Sundays as well) and after the end of treatment (at home); therapists, already trained on the use of behavioral techniques, receive consistent supervision; treatment plans are individualized; meals are fully integrated in the psychoeducational daily activities, thus contributing to a pleasant experience even in treatment settings.

No difference was found in the duration of meals, although it is worth noting that the duration was kept as usual, while greater food variety and texture were consumed (2 to 3 dishes); furthermore, the total mealtime remained within acceptable parameters of duration (30 to 35 minutes).

At follow-up, BAMBI-18 raw scores turned out to be increased in both groups; differences between baseline and follow-up remained statistically significant, thus indicating that the new feeding habits, acquired during treatment, have been sufficiently maintained; in addition, differences between post-treatment and follow-up in the ID group did not reach the statistical significance. This result is most likely related to the family involvement in the treatment process, with consistent guide by professionals that enabled parents to manage mealtimes and intervene on behavioral problems. The slight increase detected in inappropriate eating behaviors may lead to the assumption that behavioral procedures had not been accurately implemented at home. In the study by Mueller et al.<sup>56</sup>, cited above, the authors state that feeding treatments appeared to be relatively robust in the face of mistakes and that it is not clear how the level of exposure to the treatment, conducted by trained therapists, contributed to the resilience during violations of treatment integrity.

In the ASD group, a statistically significant difference was found in the comparison between post-treatment and follow-up; the analysis of BAMBI-18 subdomains showed a difference in "mealtime rigidity", with a preference for food prepared and served in a particular way, and limited flexibility

about mealtime routines. In our sample, children with ASD showed high rigidity at baseline, and this feature, though improved, appears to be the most resistant to change, probably due to the fact that the insistence on sameness is a peculiar characteristic of the autism spectrum disorder; in the DSM-5, indeed, this feature (insistence of sameness, inflexible adherence to routines) falls within the second criterion (restricted, repetitive patterns of behavior, interests, or activities) for diagnosing autism, and among the examples provided, there is the need to eat the same food every day.

This study present with some limitations: first, the small size of the sample, that implies the need to establish the effectiveness of the treatment on larger samples; second, the use of a non-randomized design, that we have chosen because of ethical implications in clinical practice, thus preferring to enroll children based on their ranking in the waiting list; third, this treatment is a behavioral package, and it's not clear whether positive outcomes result from the approach used, or they are rather the consequence of specific procedures and/or intervention intensity. Future research studies focused on this issue are strongly recommended. The fourth limitation is that the intensity of the program limits its feasibility and generalizability, because it requires a consistent participation of parents who are often forced to reach a treatment setting away for their homes; in fact, these types of treatment, are not easily available in the local communities. Another limitation is that parents were not followed up at home, therefore, we lack information about the accuracy of treatment generalization at home; it might be useful to include in the protocol supervision steps through videotapes, in order to maintain accuracy in the application of procedures and, at the same time, overcome problems related to the distance between children's house and the center. Finally, children have been followed up after one year: it would be advisable to include in the protocol periodic follow-ups at shorter intervals, for promptly intervening whenever children shift back to inappropriate behaviors, as presented before the training.

## CONCLUSIONS

The day-center-based behavioral intervention for feeding problems seems to have been effective in improving feeding behaviors of children with ASD and ID. Results thus achieved might be highly relevant in the social context, as for the normalization process of daily living of children and their families, simultaneously increasing social participation opportunities. Moreover, physical well-being, as assured by an adequate diet, might reduce the use of medical assistance and hospitalizations, and also improve psychological well-being of parents.

If the effectiveness of the program is confirmed by future studies, this kind of intervention might represent an interesting model for treating feeding problems in children with special needs, since its application is suitable in day service settings (with lower costs than those in residential or hospital settings); moreover, the relatively short duration of the treatment in face of results achieved might guarantee an optimal cost-benefit ratio.

The program could be adopted in other rehabilitation or psychoeducational centers for children with autism or ID, especially those dealing with preschoolers.



### *Improvements in mealtime behaviors of children with special needs*

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