Pediatric Feeding and Dysphagia Newsletter

Dear Fellow Feeders:

Happy New Year! Welcome to the first issue of 2009. In this issue, we have a detailed article about anatomy and development in relation to the upper airway and feeding progression, our second installment of a 3-part series on behavioral feeding from Ben Zimmerman who is from the Los Altos Feeding Clinic, and the usual (a case, editorial, resource and of course interesting research!). Please note that I am changing my email to:

feedingnewsletter@gmail.com Enjoy, Krisi Brackett

P.S. Many of you who have attended my workshops have asked about the tape measures I use as reinforcement—if you are interested in purchasing one or several, please email me.

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Special Points of Interest:

- ☺ Current information
- ☺ New products
- ☺ Research and publications
- ☺ Education

Editorial assistance provided by Elizabeth Crais Ph.D. *CCC* SLP , Division of Speech and Hearing Sciences, UNC-Chapel Hill

Inside this issue:

Anatomical and Developmental Considerations of the Upper Aerodigestive Tract on Feeding Progression

by Memorie Gosa, M.S. CCC-SLP, LeBonheur Children's Medical Center, PhD student, University of Memphis, gosam@lebonheur.org

Typical, healthy infants are born ready to feed. A series of primitive reflexes, congenital anatomical configuration of the upper aerodigestive tract and resulting physiological processes of suckling and swallowing enable healthy newborns to safely consume liquid calories in order to promote growth and maturation. For most children, feeding follows a predictable, developmental progression driven by physical and neurological maturation. The generally accepted progression of feeding development can be summarized into five distinct stages: 1) Nipple feeding, 2) Taking food from a spoon, 3) Chewing, 4) Self feeding, 5) Managing a cup or bottle (Evans Morris & Dunn Klein, 2000; Kelly Dailey Hall, 2000; Nancy B. Swigert, 1998). Each stage of feeding development depends on the physical growth and maturation of the infant. The accepted feeding progression seen in typical infants may, at least in part, be due to the growth and changes of the aerodigestive tract that take place during the first six years of life. While most feeding clinicians have a general understanding of the developmental feeding progression, they do not always demonstrate an understanding or appreciation of the craniofacial and upper aerodigestive tract growth and development that coincides with feeding development. Understanding of the growth and development of the upper aerodigestive tract will no doubt assist the speech-language pathologist in providing accurate diagnosis and effec-

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tive treatment of dysphagia in the pediatric population (Newman, 2000). This article will review the relationship between the development of the basicranium and the anatomical arrangement of the upper aerodigestive tract in humans.

Infant Anatomy and Development

While initial nipple feeding is achieved by a reflexive response, it is important to consider the underlying anatomical configuration of the infant's upper aerodigestive tract that makes feeding possible. In human beings, the upper aerodigestive tract includes the oral, pharyngeal, nasal cavities, and larynx. All of the structures of the upper aerodigestive tract in combination are responsible for respiration, swallowing, and speech. (Newman, 2001). It is well established that infants' upper aerodigestive tracts are unique in their anatomical relationships and can not simply be thought of as miniature adult upper aerodigestive tracts (Newman, 2001; Suzanne Evans Morris, 1990). In examination of a typical, healthy infant's upper aerodigestive tract, a clinician can appreciate multiple distinct differences as compared to an adult's upper aerodigestive tract (Christine M. Sapienza, Bari Hoffman Ruddy, & Susan Baker, 2004; Newman, 2001; Richard J. Carr, David S. Beebe, & Kumar G. Belani, 2001). The major anatomical differences are represented in the following review.

Beginning with the oral cavity, it is important to note the relatively small size of the oral cavity in the infant secondary to the small size and placement of the mandible. Additionally, one would note the presence of sucking/buccal pads in the oral cavity of the infant (Newman, 2001). Additionally, inside the oral cavity, it is important to note that the tongue is relatively large, takes up most of the space in the oral cavity, and is housed entirely in the oral cavity (Newman, 2001; Richard J. Carr et al., 2001). The normal infant also has a relatively large head with shorter neck as compared to the adult head and neck regions.

Next, it is important to note that the infant's nasal passages are much smaller than that of the adult counterpart. The infant larynx is considerably smaller, located in a more superior position in the pharynx, and shaped differently than its adult counterpart (Richard J. Carr et al., 2001). As a result of the cauded position of the larynx, the epiglottis is located in a higher position in the pharynx and frequently makes contacts with the soft palate (Newman, 2001; Urania Magriples & Jeffrey T. Laitman, 1987). The tip of the epiglottis has been documented in a position as high as C2 in infants less than six months of age which is significantly higher than the adult epiglottis tip which is most frequently reported as being at the level of C5 (Newman, 2001; Richard J. Carr et al., 2001). In approximately 50% of infants, the epiglottis is omega in shape. The laryngeal cartilages of the infant contain little calcified structure. The resulting subglottal space is the narrowest part of the aerodigestive tract in contrast to the adult where the narrowest portion is the glottis (Christine M. Sapienza et al., 2004). The hyoid bone is also located in more superior position in the infant pharynx and is in fact located almost directly beneath the base of tongue. The opening to the eustachian tubes in the infant is located at the floor of the nasal cavity compared to the adult where the opening of the eustachian tube lies directly posterior to the inferior nasal conchea (Newman, 2001).

The intrinsic structure of the larynx is also noticeably different in infants. The overall size of the larynx is smaller than that of an adult larynx. The length of the vocal folds in infants is only 2.5-3.0 mm, significantly smaller than the adult vocal fold length of 17-21 mm. The vocal fold mucosa is less thick in the infant versus the adult vocal folds (Christine M. Sapienza et al., 2004). Finally, the

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Anatomical and Developmental Considerations of the Upper Aerodigestive Tract on Feeding Progression by Memorie Gosa, M.S. CCC-SLP, LeBonheur Children's Medical Center

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vocal folds in infants are angled with more prominent anterior attachment as compared to adult vocal folds (Kurtis A. Waters, Peak Woo, Anthony J. Mortelliti, & Ray Colton, 1996; Richard J. Carr et al., 2001). The differences in the anatomy of the infant upper aerodigestive tract are believed to provide optimal arrangement for safe, effective nipple feeding (Newman, 2001).

Lessons from Comparative Anatomy

To fully appreciate the opinion that infant anatomical configuration is optimal for nipple feeding, it is necessary to consider the work of comparative anatomists. Humans as a distinct species exhibit a variety of specialized anatomical and systematic features. One of the most uniquely human anatomical characteristics is the arrangement of the upper aerodigestive tract, specifically laryngeal positioning in the pharynx (Jeffrey T. Laitman, 1984; Jeffrey T. Laitman & Joy S. Reidenberg, 1993).

Laryngeal positioning in the pharynx is perhaps the most important factor in determining a species capacity for breathing, swallowing, and vocalization capabilities (Jeffrey T. Laitman, 1984; Jeffrey T. Laitman & Joy S. Reidenberg, 1993). Most mammals at all stages of natural postnatal development have the respiratory advantage of high laryngeal position in the pharynx. In most land mammals, the tip of the larynx (epiglottis) lies at C1 (first cervical vertebrae) and extends inferiorly to C3 to C4 (third and fourth cervical vertebrae). Subsequently the hyoid bone and related musculature lie at a relatively high position in the pharynx. The tongue is then positioned almost entirely within the oral cavity with no part of the tongue forming any boundary of the pharynx (Jeffrey T. Laitman & Joy S. Reidenberg, 1993).

This high positioning of the larynx allows the epiglottis to move directly up and posterior to the velum. When this occurs, it creates the intranarial position of the larynx (laryngeal position with opening of larynx directly to the nasopharynx) or what is commonly referred to as the basic mammalian pattern. Some authors refer to this intranarial positioning as locking of the larynx into the nasopharynx. The intranarial laryngeal positioning allows for direct communication for air from the nostrils through the nasal cavities to the nasopharynx, into the larynx, and then to the trachea and lungs. Liquid and food can then be ushered to either side of locked larynx via the valleculae and lateral food channels to the pyriform sinuses, then to the esophagus and continuing down through the gastrointestinal tract with ultimate termination at the anus. It has been reported that this arrangement allows for continuation of respiration during feeding and in essence creates two separate pathways—one for respiration and one for digestion. While optimal for feeding, this prevents other mammals from producing uniquely human speech because the laryngeal positioning severely restricts the supralaryngeal portion of the pharynx. This restriction results in a very limited amount of total area available to modify the sound generated by the vocal folds. The lack of pharyngeal space available for sound modification results in an extremely limited repertoire of vocalizations for other mammals. This positioning and subsequent constriction of pharyngeal area is in direct opposition to the lower position of the larynx in adult humans which creates a multifunctional, upper aerodigestive tract with adequate pharyngeal volume available for sound modification (Jeffrey T. Laitman, 1984; Jeffrey T. Laitman & Joy S. Reidenberg, 1993).

The basic mammalian pattern is in direct opposition to the adult, human pattern; however, it shares many features with

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the previously discussed human infant arrangement of the upper aerodigestive tract. Infants share anatomical arrangement of their upper aerodigestive tract with that of monkeys and apes. For many years it was hypothesized that infants breathed and swallowed utilizing the intranarial laryngeal positioning (described above) of their anatomical matches, the monkeys and apes ((Jeffrey T. Laitman, 1984; Jeffrey T. Laitman & Joy S. Reidenberg, 1993). In recent literature published on the topic of infant suckling and swallowing coordination, there is a growing body of evidence to suggest that the previously mentioned notion of breathing and swallowing simultaneously during feeding is not utilized by human infants (Bronwen N. Kelly, Maggie-Lee Huckabee, Richard D. Jones, & Christopher M. A. Frampton, 2007).

Most recently, Bronwen et al (2007) provided the first published report of the maturation of breathing and swallowing during feeding for a small number (n=10) of infants during the first year of life. They concluded that human infants like their mature, adult counterparts, do not breathe and swallow at the same time. Instead, the evidence from their study suggests that despite the anatomical arrangement with high laryngeal positioning, the majority of their subjects followed a nutritive swallow with an expiration regardless of post gestational age (Bronwen N. Kelly et al., 2007). The high laryngeal position found in human infants does result in the necessity of nose breathing and severely limits the repertoire of sounds that infants are able to produce. The limitation of vocalization is most likely the result of the restricted supralaryngeal area of the pharynx. The supralaryngeal portion of the pharynx is responsible for modifying the sounds generated by the vocal folds. The larynx eventually descends further into the pharynx, ultimately creating the adult laryngeal configuration that is most ideal for human speech (Jeffrey T. Laitman & Joy S. Reidenberg, 1993).

Influence of the Basicranium and Maturational Changes of the Aerodigestive Tract

The laryngeal descent that ultimately results in the human pattern of respiration, swallowing, and speech is heavily influenced by the growth and development of the basicranium (Jeffrey T. Laitman, M. Phil, & Edmund S. Crelin, 1976; Jeffrey T. Laitman, 1984; Jeffrey T. Laitman & Joy S. Reidenberg, 1993). The basicranium is the underside of the skull (not including the hard palate). It forms the base of the calvarium (braincase) and posterior portion of the pharynx. The growth and change of the basicranium is influenced by the growth and changes in the calvarium, pharynx, face, and secondary palates. In the fetal, infant, and early toddler periods much of the growth and change in the basicranium is a direct result of neurologic changes resulting from the rapid growth of the brain during this time. Also during the postnatal period, nasal influences and pharyngeal influences play a significant role in the changes of the basicranium (Robert S. Holzman, 1998).

In all mammals (including human infants) except for mature adults the high positioning of the larynx allows for an intranarial position of that structure to create a direct air tube from the nasopharynx to the larynx. With this basic mammalian arrangement of the larynx and other upper aerodigestive structures, the basicranium of human infants shows a general flatness with no marked angulation "between the basilar portion of the occipital bone anteriorly towards the spheno-occipital synchondrosis nor is there an angle to the plane of the basilar portion of the sphenoid posteriorly towards the synchondrosis" (Jeffrey T. Laitman et al., 1976). The absence

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of that angulation from the hard palate to the most anterior point of the foramen magnum gives the basicranium what is characterized as a flat appearance. Sometime between two and four years of age the upper aerodigestive tract begins the characteristic changes that bring about the uniquely human configuration of the upper aerodigestive tract (Jeffrey T. Laitman et al., 1976).

The tongue begins its gradual descent from its infantile position of being housed entirely in the oral cavity to its mature position with the tongue base in the pharynx between the second and fourth years of life. During the fourth to fifth year of life, the tongue achieves its permanent position with the root of the tongue being housed in the pharynx and composing the anterior portion of the oropharynx. As a result of the lingual descent, the larynx no longer makes contact with the soft palate via the epiglottis. This position reflects a significant increase in the supralaryngeal area of the pharynx available for sound modification. At the conclusion of this lingual and laryngeal descent, typically achieved by approximately six years of age, the basicranium now reflects some of the distinctive characteristics of an adult human. This is evidenced by the basilar portion of the occipital bone now angling from the basion anteriorly towards the synchondrosis. Additionally, there is a shortening of the distance between the hard palate to basion with a resulting reduction in the distance from the vomer bone to the synchondrosis. The final characteristic change in the basicranium that creates the mature, adult configuration of the upper airway occurs after puberty with the joining of the sphenoid and occipital bones. In the final mature, adult configuration the change of the basicranium has been from almost an entirely flat basicranium to a distinctively and uniquely human characteristically curved basicranium between the hard palate and foramen magnum (Edmund S. Crelin, 1989; Jeffrey T. Laitman et al., 1976). This curved angulation of the basicranium results in a sharp angulation of the upper aerodigestive tract. Throughout human maturation it is the gradual change from the newborn flat orientation of the basicranium to the mature flexed position of the basicranium that drives the descent of the hyoid, tongue, and larynx into the neck (Nathan Jeffery, 2005).

Several research papers have given more specific insight into the growth and development of the upper aerodigestive tract from infancy to adulthood (Houri K. Vorperian et al., 2005; N. Rommel et al., 2003; Raanan Arens et al., 2002). Rommel, et al (2003) published results from a study designed to assess the growth of the oropharyngeal area and hypopharynx in infants with videofluroscopy. Through prospective review of videofluroscopic imaging of 23 children between birth and 4 years of age, the authors determined that there does not appear to be a significant difference in pharyngeal growth between females and males. This is in direct opposition to reported results from previous studies that determined that there is a distinction in pharyngeal growth rates based on sex (N. Rommel et al., 2003).

Results from Arens, et al (2002) provide new information on the change of the linear dimensions of the upper airway structure during early development. Arens and colleagues utilized magnetic resonance imaging (MRI) to describe the upper airway and surrounding tissues in typical children during development. Specifically they were interested in recording the anatomic changes of this area that might lead to sleep apnea in children. They concluded that the lower face skeleton grows linearly along axial and sagittal planes during the first eleven years of life. Additionally they report that the soft tissues of this region grow proportionally to the skeletal structures during that same period from one to eleven years post gestational age (Raanan Arens et al., 2002).

Finally, Vorperian and his colleagues undertook an ambitious research project designed to quantitatively characterize the

anatomic development in the bony and soft-tissues structures of the vocal tract (aerodigestive tract) during the first two decades of life. They also used MRI technology to assess the relational growth of structures along the length of the vocal tract in 63 children ages birth to ~6 years of age and 12 adults. Their results are summarized in the following: there is continual growth of all oral and pharyngeal structures of the vocal tract with no difference among the sexes but with a period of accelerated growth occurring between birth and 18 months of age, the structural region of the vocal tract (oral anterior versus pharyngeal posterior) and orientation (vertical as opposed to horizontal) determine the growth pattern of the vocal tract, relational growth dimensions of various structures along the length of the vocal tract change with development while the simultaneous increase in vocal tract length during development is largely due to growth of the pharyngeal/posterior structures, and vocal tract length is significantly impacted by the growth of the anterior oral structures during the first 18 months of life (Houri K. Vorperian et al., 2005). As previously discussed, all of the growth and changes documented in these research projects are directly influenced by maturational changes of the basicranium and related structures.

Conclusions

Most infants progress from primarily reflexive feeding patterns supported by the flat angulation of the basicranium and mammalian-like arrangement of the upper aerodigestive tract into more sophisticated, learned oral motor patterns of biting and chewing and cup drinking supported by the development of the flexed angulation of the basicranium and uniquely human arrangement of the upper aerodigestive tract without difficulty. Feeding clinicians are charged with the task of helping those infants and children that present with difficulty along that path. Feeding clinicians are in the unique position of being able to aid these patients in management and habilitation of their oral feeding skills to ensure progression to developmentally appropriate foods and oral motor patterns. It is essential for those involved in the diagnosis and management of pediatric patients with feeding difficulties to be well versed in not only the typical progression of feeding development but also in the underlying craniofacial and upper aerodigestive tract growth and development that coincides with typical feeding skill progression.

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Part 2: An Introduction to Behavioral Feeding Protocol Formulation

By Ben Y. Zimmerman, BS, MS Behavioral Psychology, Los Altos Feeding Clinic Email: pediatric_feeding@sbcglobal.net for correspondence, www.pediatricfeeding.org

This is the second part in a three part series on the effectiveness of behavior analysis in reducing or eliminating pediatric feeding disorders. This part will describe ways to formulate behavioral protocols for feeding therapy. Part 3 will examine case studies.

There is an infinite number of variables that shape the occurrence of a targeted behavior. No two children have the same ontogenic histories that affect their mealtime behaviors. Some children do behaviors A, C and F, while others may do behaviors B, C, and E. Every child has their own unique protocol. Each protocol must take into account the specific behaviors of the child being treated. There is no single protocol that fixes acceptance to food. There are three major categories that define the parameters of protocol formulation. These categories include contingencies, schedules of reinforcement and shaping.

Contingencies

Contingencies are the context in which a behavior is performed, the behavior itself and the consequences of that behavior. For instance, a child is presented with a bite (context), the child opens his mouth for the bite (behavior), and access to a toy is given (consequence). Not only does a contingency need to be determined in terms of when a target behavior is being performed, but also determined when the target behavior is absent in the context that signals that the behavior should be present. If a bite is presented and the bite is not taken, then the consequence must change in order for the contingency to be effective.

Schedules of Reinforcement

"Reinforcement" should be stipulated in a protocol by how often it occurs. The rate of reinforcement can be formulated by using either frequency or time. In most cases, feeding protocols use frequency for the schedule of reinforcement.

Rate of Reinforcement Using Frequency

A reinforcer can be dispensed at a predetermined number of occurrences of your targeted behavior. Access to a toy can be given at each bite. An effective way of applying this in the context of treating feeding disorders would be to gradually make the rate of reinforcement leaner. After establishing a behavior, when reinforcement is presented at each occurrence of a bite, it could then be faded to every three bites, then to every five bites, to every ten bites, and finally, taken away completely. This allows the removal of the dependence on a tangible reinforcer for eating to take place. The ultimate goal would be for satiation, a naturally occurring reinforcer, to reinforce the behavior of eating.

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Differential Reinforcement of a Behavior

There are many behaviors that are emitted during a feeding session. It is not always effective to reinforce all targeted behaviors. Targeted behaviors not only include acceptance to a bite, swallowing a bite, or taking a scoop of food, but also crying, head turning and batting at a spoon. The latter behaviors would increase in frequency if reinforced, therefore, many times these behaviors are put on extinction. No reinforcement would be given following the occurrence of crying, turning the head, batting the spoon, etc. Reinforcement could include turning one's head towards the child, saying, "stop that," holding the child's hand, or any sort of attention.

Shaping

Many times the behavior that is targeted does not exist in a particular child's repertoire. This behavior must be created anew. This could pertain to anything from mouth openings to self-feeding. An example of shaping a mouth opening would be to present the spoon and if there was a slight mouth opening, then praise would be given. Then praise would only be given for a bigger mouth opening and so on until the approximated behavior of a full mouth opening was achieved.

Putting the Three Categories Together to Form a Sample Protocol

*Present bite. If bite is consumed within three seconds of the presentation of the spoon, then turn the TV on for a period of 15 seconds (*contingency*). If the bite is not accepted within three seconds of the presentation of the spoon, do not turn on the TV and repeat presentation of the spoon. Turn TV on after every bite that is accepted within three seconds (*rate of reinforcement*). When sitting in a forward position in the chair, verbally prompt child to sit back. Every time the child's back moves closer to touching the back of the chair, give the child praise (*shaping*).*

Malott, R.W. (2007). *Principles of Behavior*. New Jersey: Prentice Hall.

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Case by Case: NP: 14 month CA; 12 months AA

History: NP was the 2 lb, 13 oz product of a 30-week gestation complicated by NEC without surgery, gastroesophageal reflux, and a grade 1 brain bleed. By report, NP has been vomiting 2-3 times per week from birth. Vomiting is typically after feeding. She has a history of gagging, poor sleeping, 3 ear infections, and difficulty feeding. Mom reported a past history of congestion that appears to be resolving. She is not on any medicine.

Feeding: NP drinks 3-4 bottles (4-6 oz.) of regular formula. She never accepted baby foods. She accepts table foods inconsistently (chicken nuggets, yogurt, cereal) and is difficult to feed. She refuses rice cereal, vegetables, meat sticks, refried beans, and mac/cheese (foods she once ate). She had a normal oral motor exam and has no difficulty swallowing.

Intervention: To intervene we must answer this question

What is interfering with successful feeding practice for NP?

Discussion: NP has a history of prematurity so she got off to a slow start with eating as an infant. However, she did well enough to leave the NICU as an oral feeder with good weight gain. The most obvious factor that is interfering with successful eating practices is GI. She has a history of NEC and has been vomiting on average of 2-3 times per week her entire life. More subtle indicators of GI problems include gagging, poor sleeping, congestion, ear infections, inconsistent feeding with refusals.

Intervention: If we believe that NP's GI system is interfering with feeding progress then the place to start is to make her GI system more comfortable. After a discussion with her doctor, she was placed on Prevacid 7 mg 2X/day. 3 weeks after initiating medication, mom was not sure if it was helping. Dad who is a pharmacist, felt that she was eating more volume of preferred foods. 2 months on the Prevacid, she is no longer vomiting and eating everything. NP was discharged from therapy.

Editorial: **Try to answer the important question: What is interfering with successful feeding for this child?**

There are strong biological and social drives to eat. Therefore when a child is not eating enough to thrive or consistently refusing foods, there is a reason. The first step in intervention is to ask that question; **What is interfering with successful feeding for this child?** The most common factors that interfere with progress are medical (i.e., gastrointestinal, respiratory), motor abnormalities (cerebral palsy), and learned patterns of behavior. (Manno, C., Fox C. , Eicher P., and Kerwin,M. (2005) Early oral motor interventions for pediatric feeding problems: what, when, and how. JEIBI, vol 2, no 3, Fall, page 145.) Identify these specific factors and work with the medical team to improve them, which will allow the child the opportunity for have success.

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On the Research Front:

Kindermann A, Kneepkens CM, Stok A, van Dijk EM, Engels M, Douwes AC. Discontinuation of tube feeding in young children by hunger provocation. J Pediatr Gastroenterol Nutr. 2008 Jul;47(1):87-91.

The authors investigated whether children younger than 2 years with pathological food refusal (PFR) who had been dependent on tube feeding for at least 3 months, could be weaned from tube feeding with a multidisciplinary hunger provocation program. The program included 5 weaning steps. Primary endpoints were eating without tube feeding while gaining weight at 3 and 6 months after discharge. Results indicated that at follow-up after 3 (9 of 10) and 6 months (8 of 10), were eating adequately and gaining weight without tube feeding. Two children with recurrent infections resumed partial (25%-50%) tube feeding during follow-up. Authors report that this seems to be a promising method to promote discontinuation of tube feeding in young children.

Indrio F, Riezzo G, Raimondi F, Bisceglia M, Cavallo L, Francavilla R. The effects of probiotics on feeding tolerance, bowel habits, and gastrointestinal motility in preterm newborns. J Pediatr. 2008 Jun;152 (6):801-6. Epub 2007 Dec 26.

This study investigates the effect of dietary supplementation with a probiotic on feeding tolerance and gastrointestinal motility in healthy formula-fed preterm infants. Thirty preterm newborns were enrolled; 10 were exclusively breast-fed, and the remaining 20 were randomly assigned in a double-blind manner to receive either Lactobacillus reuteri ATCC 55730 (at dose of 1 x 10(8) colony forming units a day) or placebo for 30 days. Clinical symptoms of gastrointestinal function (regurgitation, vomiting, inconsolable crying, and evacuation) and physiological variables (gastric electrical activity and emptying) were recorded before and after the dietary intervention. Results indicted body weight gains per day were similar for the 3 groups, and no adverse events were recorded. Newborns receiving probiotics showed a significant decrease in regurgitation and mean daily crying time and a larger number of stools compared with those given placebo. Gastric emptying rate was significantly increased, and fasting antral area was significantly reduced in both the newborns receiving L. reuteri and breast-fed newborns compared with placebo. Results suggest a useful role for L. reuteri supplementation in improving feeding tolerance and gut function in formula-fed preterm newborns.

Twachtman-Reilly J, Amaral SC, Zebrowski PP. Addressing feeding disorders in children on the autism spectrum in school-based settings: physiological and behavioral issues. Lang Speech Hear Serv Sch. 2008 Apr;39(2):261-72.

The purposes of this article are to define the nature of feeding difficulties in children with autism spectrum disorder (ASD), identify important components of the assessment and treatment of feeding disorders specific to this population, and delineate specific therapeutic techniques designed to improve assessment and treatment within the school setting.

Boccia G, Buonavolontà R, Coccorullo P, Manguso F, Fuiano L, Staiano A. Dyspeptic symptoms in children: the result of a constipation-induced cologastric brake? Clin Gastroenterol Hepatol. 2008 May;6(5):556-60. Epub 2008 Apr 18.

Patients with constipation frequently complain of dyspeptic symptoms that may be explained by reflex inhibition of upper-gastrointestinal motor activity by colonic stimuli. Authors evaluated (1) the prevalence of functional constipation (FC) and gastric emptying with functional dyspepsia (FD), and (2) the efficacy of osmotic laxatives on constipation, dyspeptic symptoms, and gastric motility in 42 children. Conclusions indicated, the majority of children with FD were affected by FC associated with delayed gastric emptying. Normalization of bowel habit may improve gastric emptying as well as dyspeptic symptoms.