

# JCCP

## JOURNAL OF CLINICAL CHIROPRACTIC PEDIATRICS



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# JCCP JOURNAL OF CLINICAL CHIROPRACTIC PEDIATRICS

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# GUIDELINES FOR AUTHORS

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# JCCCP JOURNAL OF CLINICAL CHIROPRACTIC PEDIATRICS

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The *Journal of Clinical Chiropractic Pediatrics* welcomes original and scholarly manuscripts for peer-review and consideration for publication. Topics must pertain to the field of pediatrics which includes pregnancy and adolescence. Manuscripts should not have been published before or submitted to another publication.

## The following will be considered:

**Case Reports and Case Series** – presentations of individual or groups of cases deemed to be of interest to the professional and scholarly community.

**Pilot Studies or Hypothesis** – papers which, while very broad, present with a clear hypotheses and suggest a foundation for future, in-depth studies.

**Literature Reviews** – studies of existing papers and books presented with the intention of supporting and encouraging new and continuing study.

**Technical Descriptions** – reports of new analytical/diagnostic tools for assessment and delivery of care. Controlled, Large Scale Studies – usually, but not necessarily, performed at a college or research facility. May be double-blinded.

**Commentaries** – presentations of opinion on trends within the profession or current events, pertaining to pediatric and adolescent chiropractic care.

## Guidelines for submission

All manuscripts are accepted purely for consideration. They must be original works and should not be under consideration by any other journal or publisher at the time of submission. They must be accompanied by a TRANSFER OF COPYRIGHT form, signed by all authors and by the employer if the paper is the result of a “work for hire.” It is understood that while the manuscript is under consideration it will not be sent to any other publication. In the case of multiple authors, a transmittal letter should designate one author as correspondent.

Manuscripts may be sent to editor at [svallonedc@aol.com](mailto:svallonedc@aol.com). Manuscript should be in document style MS Word (or compatible) and unformatted. PDFs will not be accepted.

**The paper** must include an abstract or summary. This abstract/summary should state the purpose of the paper (objective), procedures, methods, main findings (results) and principal conclusions. Also, any key words or phrases that will assist indexers should be provided.

**References** must be cited for all materials derived from the works of other people and previously published works. Reference numbers in superscript must be assigned in the order of citation in the paper.

**Tables** – Each table or figure should be on a separate page and not imbedded in the manuscript. If the table is from another publication, permission to publish must be granted and the publication acknowledged.

**Photographs** – Photographs may be in color or in grayscale and scanned at 300 dpi with sharp contrast. Patient photographs must have consent form signed by the individual or parent or guardian in the case of a minor.

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**Acknowledgements** – Any illustrations from other publications must be acknowledged. It is the author’s responsibility to obtain written permission from the publisher and/or author for their use.

All manuscripts deemed appropriate for publication by the editor will be sent blind to at least two reviewers. If the manuscript is accepted, the author will be notified. If substantive changes are required, the paper will be returned to the author and the author must re-submit a clean copy of the revised manuscript. Author will be given a tentative date for publication if accepted. Manuscripts not accepted for publication will be returned to the author without comment.

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## Instructions to Authors – Summary

See *Uniform Requirements for Manuscripts Submitted to Biomedical Journals* for detailed information <http://www.icmje.org/>.

### General formatting guidelines

- All submission components must be submitted electronically.
- Only manuscripts in English are accepted.
- Submit manuscripts as **Microsoft Word** documents.
- Use 1" margins on all sides
- Use Arial 12 point black font
- Capitalize only the first letter in the title, and any proper nouns.
- Do not justify text.
- Do not use column function
- Number all pages at bottom right.
- Double-space manuscript. Single-space references, tables or figure legends.
- Do not abbreviate words or terms the first time they are introduced; at that time, provide the abbreviation in parentheses and use it from that point forward.
- Number citations consecutively using superscripted Arabic numerals and place all references in a **Reference** section immediately at the end of your section.
- Run spell check and grammar check after completing the manuscript. Use American English spelling and units of measurement.

### Submission Components

- **JCCP authorship form**—submit separately from manuscript. All authorship forms may be combined in a single PDF. Each author must complete this form, scan and return it electronically to the editor before the manuscript can be processed.
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- **Permission to acknowledge forms:** All individuals named in the Acknowledgements section of the manuscript must sign a permission form. The corresponding author may use his or her own form, or use the one JCCP provides—submit separately from manuscript. All permission forms may be combined as a single PDF.
- **Cover letter**—submit as separate document, either Word or PDF.

**The following items MUST be submitted as a Word document.**

**Cover letter**—Explain why your manuscript is appropriate for JCCP.

**Document**— Each of the following should be on a separate

page. Use page break function to separate page, not repeated line breaks to get to a new page.

- Title page
- Abstract
- Manuscript
- Acknowledgements
- References
- Tables
- Figures

### Title page

- Title of article—**ONLY CAPITALIZE FIRST LETTER OF FIRST WORD**
- Running head (limited to 40 characters)
- Word count (excluding references, tables and figures)
- Number of tables
- Number of figures
- Authors
  - Name, with all degrees (do not include Bachelor's level degrees)
  - Current title/position and affiliation, including city, state and country
- Corresponding author
  - Name
  - Mailing address, phone, fax
  - E-mail address; provide alternative e-mail address if possible

**Abstract—not to exceed 250 words.** It may be structured or unstructured. Structured abstracts usually include the following sections: Purpose, Methods (include study design in this section), Results, Conclusion. For case reports and case series, see document, "Instructions for Case Reports and Case Series."

### Manuscript Components

Manuscript length will vary with the type of article; in general, manuscripts are expected to be 1,500-3,000 words in length, excluding references, tables and figures. These may vary with the type of article. For case reports and case series, see, "Instructions for Case Reports and Case Series." In general, for manuscripts reporting research studies, the order of components is:

- Introduction: succinctly describe the relevant literature supporting the need for the study.
- Methods: describe the methods used to accomplish the study, in detail sufficient to allow the informed reader to evaluate their appropriateness.
- Results: present the results of the study, without interpretation.
- Discussion: describe limitations of the study; interpret results; compare results to those of other relevant studies; discuss value and implications of the study.
- Inclusion of appendices is discouraged.

# Instructions to Authors – Summary

## Tables

- Number tables consecutively in text, using Arabic numerals (1, 2, 3 etc.)
- Place each table on a separate page at the end of the section, immediately following the References section.
- Use “table” function in Word to construct tables; do NOT use tab or space keys to form columns and rows. Use table “normal” style to construct table. Do not insert vertical lines between columns; do not use grids. Place horizontal line under table title and at end of table, separating the table from any footnotes. You may place horizontal lines under headings in the table for clarity.
- Use footnotes to explain details at bottom of the table (below a horizontal line). Identify using either superscripted lower-case letters or standard footnote symbols (sequence: \*, †, ‡, §, ||, ¶, \*\*, ††). Sequence the footnotes in the order text is read—from left to right and then down.
- Use left-justification to align numbers in columns.

## Figures

- Place figure title and legend on page with the figure.
- Figures must be submitted electronically. Acceptable file formats: DOC, JPG, PDF. Figures may be embedded at the end of the manuscript text file or loaded as separate files for submission purposes. Should not be imbedded within the manuscript text
- Hand-drawn illustrations are not acceptable.
- Provide documentation of permission for any figures that are not original.

## Acknowledgements

Include a statement disclosing any funding support for the project or project personnel, or any other potential conflicts of interest. Acknowledge only individuals or organizations who provided input or resources to the project that were above and beyond their usual responsibilities. All individuals acknowledged must provide written permission to use their name; these permissions must accompany the manuscript at the time of submission (scan documents and submit electronically).

## Reference format—examples

- *Journal article*: Jefferies LJ, Milanese SF, Grimmer-Somers KA. Epidemiology of adolescent spinal pain: A systematic overview. *Spine* 2007;32:2630-2637.
- *Book*: Task Force on Community Preventive Services. Guide to Community Preventive Services. New York: Oxford University Press; 2005.
- *Website/webpages*: Author. Title. Name of website. URL. Date of publication. Updated date (if applicable). Date accessed. Example: Fox F. Promoting and sustaining collaborative networks in pediatrics. Pew Research Center. <http://www.pewinternet.org/2013/06/14/promoting-and-sustaining-collaborative-networks-in-pediatrics/>. Published June 14, 2013. Accessed September 3, 2017.

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Number of tables:

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- If no Acknowledgement section is included in the submission, there are no other contributors to the manuscript.

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*Journal of Clinical Chiropractic Pediatrics*  
Patient Consent Form for Case Report

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If patient is a minor, print parent/guardian name: \_\_\_\_\_

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(2) The material will only be published in a scientific journal.

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Signature

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Date Signed

\_\_\_\_\_  
Print Name

# Instructions for Case Reports and Case Series

---

## Abstract

The abstract should be 250 words or fewer. It may be either structured or unstructured. If structured, use the same sections as described below for the components of the report (Introduction, Case Presentation, Intervention and Outcomes, Discussion).

## Case Report Components

- **Introduction:** State why this case is unusual or important.
- **Methods:** describe the search engine and key words used to review previously published literature on the subject
- **Case presentation:** Provide a brief summary of the pa-

tient's presenting demographics, other relevant characteristics, complaint(s) and related symptomatology.

- **Intervention and outcomes:** Describe the course of treatment, including frequency and duration, and summarize the patient's clinical outcomes, using recognized outcome measures if possible. Include whether informed consent was obtained and if there were any adverse events reported.
- **Discussion:** Succinctly state the important aspects of the case, in terms of its implications for patient care in general, or for specific patient populations or conditions. You may also compare/contrast the case to other cases in the published literature. Be cautious about overstating the importance/implications of your case.

## Evidence-based Case Report Instructions

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An Evidence-based Case Report (EBCR) is NOT the same as a traditional case report. The EBCR focuses on an answerable clinical question, how it was explored in the search, appraising the results and how it applies to the case, along with the integration of this information with the patient interaction. The final stage in this process is to audit the results.

These are the steps to include:<sup>1,2</sup>

- Brief summary of the chief complaint: 50-100 words
- Briefly describe the clinical case: 250-400 words
- Explain how you developed the clinical question: 200-300 words
- Explain your search for evidence (key words, databases used, number of articles retrieved): 50-100 words
- Evaluate the articles retrieved: critically appraise the evidence for validity and relevance: 200-300 words
- Describe how you made your clinical decision by applying these findings to the case, including how you considered and integrated the patient's preferences and values: 250-400 words
- Evaluate your performance: 50-100 words

1. Heneghan C, Badenoch D. *Evidence-based Medicine Toolkit*, 2nd ed. Oxford, UK: Blackwell Publishing, 2006.

<http://onlinelibrary.wiley.com/doi/10.1002/9780470750605.index/summary> (download pdf of "all chapters" for free copy of the publication)

2. Jones-Harris AR. The evidence-based case report: a resource pack for chiropractors. *Clin Chiropr* 2003;6 73-84. (download for free from [www.chiro.org/cases/FULL/Evidence-based\\_Case\\_Report.pdf](http://www.chiro.org/cases/FULL/Evidence-based_Case_Report.pdf))

Additional interesting articles to read about EBM and writing and EBCR:

Review an example of an EBCR at:

<https://www.ncbi.nlm.nih.gov/uws.idm.oclc.org/pmc/articles/PMC1126937/pdf/302.pdf>

Iran J Pediatr. 2010 Sep; 20(3): 261—268. Evidence Based Medicine in Pediatric Practice: Brief Review

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3446038/>

J Can Chiropr Assoc. 2014 March; 58(1): 6—7. **Evidence-based case reports**

<http://pubmedcentralcanada.ca/pmcc/articles/PMC3924510/>

3 BMJ. Vol 7, Issue 3, 2002, **Evidence-Based Medicine in Practice: EBM Notebook**

<http://ebm.bmj.com/content/7/3/68>

### A message from the International Chiropractors Association Council on Chiropractic Pediatrics

**By Meghan Van Loon, DC, DICCP  
ICA Pediatrics Council Vice President**

So much has been happening and challenging us, personally and professionally, since the last issue of JCCP became available online. With the global pandemic, we are all dealing with our patients' stress (if you have been able to see patients) and the effect that it is having on them emotionally and physically. Depending on the patient's age level, that stress will be evident in different ways: emotional lability, withdrawal, pain, and many other various symptoms.

It is times like these that we need to remember what we know about chiropractic and having a peer-reviewed journal like the JCCP can be that reminder. The articles may not directly deal with COVID-19, but they are about cases and concerns that you are seeing or will see in your office. The journal is also an educational resource, which is so important in this present day of conflicting or questionable information. The JCCP can help provide the clinical experience of the field chiropractor's case report or the latest work being submitted from our chiropractic colleges to the chiropractors who practice with a pediatric specialty or those chiropractors who see children in their family practice.

As each and every one of us can benefit from more continuing education, the Council on Chiropractic Pediatrics is working on the Annual Chiropractic Pediatric Conference to be held November 6-8, 2020 in Orlando, Florida. We are

in the process of setting up the conference and taking into account COVID-19 recommendations. There are quite a few new speakers this year with new topics, including an epidemiological study of pediatric chiropractic care, SOT for the pregnant woman, pediatric cervical postural patterns and various case studies to list a few. There will be technique-oriented workshops specifically for chiropractors that are new to pediatric and pregnancy adjusting, as well as other workshops that will provide you with skills to utilize on Monday morning in the office. This is a great opportunity to get 15+ hours of CEU credits. We are also working on having some of the vendors from previous years as well as new ones. Please watch for the announcement from the ICA and the Council on Chiropractic Pediatrics about registration. This is always an educational weekend and a fun way to reconnect with friends.

As we go through our day, seeing our pregnant patients and children, try to remember what chiropractic offers to all patients: a way to assist the body to achieve wholeness and health. This has always been a key factor in chiropractic and will continue to be important as we see the children who are experiencing COVID-19 and the related health challenges that may follow. The families of this younger generation are going to need our knowledge, expertise, understanding and compassion to deal with any potential changes from this experience. And you now have two different avenues in the JCCP and the Conference to increase your knowledge base — take advantage of them for yourself and your patients.

### Thank you for all that you do!

By Sharon A. Vallone, DC, FICCP

In these surreal times, whether you are in your office or sheltering in place, We on the JCCP staff would like to send you our heartfelt regards for your courage and persistence in taking care of yourselves, your families and your patients. We are all doing the best that we can. We are all in this together.

Are any of you dealing with new roles in your life in addition to practicing chiropractic? Some of us are homeschooling children, caring for elders, working online (telehealth!), supporting patients emotionally and sharing information on how to stay safe and stay well. Some of you are writing, some teaching and many of us learning new skills we never gave much thought to ever having to learn. Zoom, for some of us, was to move fast, as we do when chasing a child around the adjusting table. Now “ZOOM” is a door into futuristic communication and opportunities to reach others around the world.

It's been a challenging and sad time for many of our comrades, seeing loved ones succumb to health challenges and not be able to gather as a family to bid them farewell. Some of us have also suffered serious health challenges ourselves during this time complicated by the nature of the burden on the healthcare system. For these friends we stand in solidarity. And to all of those who have served on the front line, in your chiropractic offices, in hospitals, on ambulance squads and fire companies, in nursing homes and those providing home and hospice care and for those who have continued to work in service situations in place or delivering goods to those who couldn't leave their homes, we owe you our gratitude.

For those in leadership roles, we look to you to bear your responsibility seriously and safeguard us while still remembering that the safeguarding of our constitutional rights as is much an important part of that responsibility. That also goes for our chiropractic leadership who have gone to great lengths to secure our scopes of practice and maintain our ability to keep our office open to serve our patients as an essential healthcare service. We owe them our gratitude as well.

As far as justifying our role as essential, this too has been a topic tossed about on the waves of the internal chiropractic communication network. Are we evidence based? Are we essential to the health and wellbeing of our patients? I think those chiropractors who have been willing and able to serve selflessly will attest to the gratitude of their patients who as a result of their chiropractic care, remain healthy and able

bodied to carry on in their position whether it be on the front line or in the home. You've heard gratitude expressed by many who found relief in your offices and didn't need to turn to the overburdened emergency room. There are many in our field who are spending time calling out for more evidence based research to support our providing care and there are those who are trying to provide it by collating a systematically reviewing the research that has been published. But we who care for our patients every day, have the clinical experience to know that what we do makes a difference for our patients and those that can, continue to work in their offices and have been willing to continue to make that difference even through these challenging times.

Our leadership has provided a beacon of light with daily communication from ICA president, Dr. Stephen Welsh, and other officers of the International Chiropractors Association like past present Dr. John Maltby. Dr. Maltby recently spoke to the ICA members about this pandemic and his joy in meeting the needs of his patients. He recalled a conference he attended in Lima, Peru when a physician was speaking on evidence based care. She drew three interlaced circles. The circles were identified as research, clinical expertise and patient needs. Dr. Maltby noticed all the circles were the same size and pointed out how no circle was larger therefore more important than the rest. Research helps us as a chiropractor to hone our skills and provide specific care to our patients but clinical expertise whether there is EBR to support it “yet” is an undeniable part of our practice whether we've been in practice 40 years or 4 years. And last but not least, are our patients needs. Patient centered care has always been as important as either of the other two. All three circles are of equal size, all of equal importance.

We serve a unique population. Our children are not untouched in this pandemic. The isolation from friends at school, baseball season being canceled, graduations and dance recitals all on hold have resulted in challenges difficult for our children to bear. Being aware of the psychological effects of this stress helps us understand behavioral changes, depression and a rising rate of pediatric suicide and possibly help intervene early by providing support and referrals to families even if that support is virtual support. Putting the emphasis on the positive, more time together as a family, helping stressed parents with ideas to both entertain and de-stress the family while they juggle working at home and helping their children with their schoolwork. Building a little extra time into our visits to allow them to decompress as many have been in isolation and may think they are the only ones going through this! We are there to remind them we are in this together. Many of you may be performing the same juggling act!

As chiropractors, we need to keep improving our skills. There are chiropractic educators who are generously offering us the opportunity to take their webinars at no cost to help improve our skills during times when we might be feeling we need to know more to be able to support our patients. We also need to keep up with the research in our own field of chiropractic, particularly pediatric chiropractic. We also need to keep up with topics that pertain to our patient population like the rise in child abuse during the lock down period or educate yourself on the incidence of presenting complications for the pediatric patient like *Pediatric Multi-System Inflammatory Syndrome Potentially Associated with COVID-19*, which shares symptoms with toxic shock and Kawasaki disease including fever, rashes, swollen glands and, in severe cases, heart inflammation and be prepared to recognize these symptoms and treat your patient and refer and appropriate for collaborative support. We may never see this in our office but knowledge is an excellent clinical tool and in my 34 years of practice, it's my colleagues that have recognized things in their office and in the field (I'm thinking a one particular doctor who's clinical eye on mission trips caught so many unbelievably rare conditions as she traveled through jungles to visit children's schools in remote villages) that have gone unnoticed or unrecognized and have played a key role in the child's recovery.

Areas we should be spending time reading and learning more about are the current guidelines and risks for pregnant patients, labor and delivery, separation of parent

and child if one tests positively for the virus, breastfeeding guidelines and pediatric complications. It's important to follow and carefully review the protocols being posted by other national and international health organizations so that we know what our patients are facing and we can support them with information to advocate for themselves if they do not agree with the current policies and ask for alternatives.

For example, the nursing dyad and COVID- 19. By doing our due diligence and accessing educational articles on MEDSCAPE, like [Postpartum Care and Breastfeeding](#) or monitoring the [The Academy of Breastfeeding Medicine website](#) will keep you abreast of current concerns and the most up to date guidelines that your patients can familiarize themselves with before they enter the hospital setting to give birth and perhaps help prevent the separation of the mother and child or interruption in breastfeeding due to misunderstood COVID-19 concerns. Information that would be helpful for our patients as they approach delivery might be the article written by Dr. Alison Stuebe published in *Breastfeeding Medicine* accessed at <https://www.liebertpub.com/doi/pdfplus/10.1089/bfm.2020.29153.ams>.

So in conclusion, thank you for all you do! For all you know and acknowledging all we have yet to learn. We appreciate you and encourage you to be gentle with yourself and others as we walk this uncharted course together. If there was ever a time for the well-developed skill of the chiropractor to "think outside of the box", it's now! Carry on!

# Is CBD appropriate for pediatric disorders?

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By Eric C Epstein, MsT, DC, CCP

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Childhood is considered a time of good health. Certainly, it is not routinely accepted that marijuana-type-products would be useful to support and promote childhood health. As a clinician who manages difficult childhood cases, particularly autistic-spectrum disorders, this author must look widely for whatever benefits are available for these children.

For the first time since the enactment of the Marijuana Tax Act in 1937, Americans have access to cannabinoids, the alkaloids found in cannabis, the plant that provides both industrial hemp and marijuana. Over the last several years, many people have reported the benefits of using hemp extracts, particularly cannabidiol (CBD), that include pain control, improved sleep, relief of a variety of digestive distress, reduction in seizures and improvements of mood.<sup>1</sup> Children suffer from these disorders, as well as adults.

Cannabidiol (CBD) is one of the highly researched active ingredients of cannabis (hemp and marijuana). CBD products are currently utilized for both adult and pediatric applications. Recently the market has been flooded with products marketed that contain CBD. CBD has been shown to have pain relieving benefits due to its action on the (Human) Endocannabinoid System (ECS).<sup>2</sup> The ECS is thought to have a regulatory influence on virtually every system of the body, particularly the nervous, endocrine and immune systems.<sup>2</sup> The ECS is the largest neurotransmitter system. There are two cannabinoid receptors: CB1 and CB2.<sup>2</sup> CBD (which does not have intoxicating properties) and THC (which does) are received by CB1 receptors. CB1 receptors are primarily found in the central nervous system and immune system.

Prior to cannabis prohibition in 1937, hemp derived cannabinoids were omnipresent in the daily diet. Hemp was used as fodder for food animals and so cannabinoids were consumed in meat, eggs and milk.<sup>1</sup> Cannabis provided one of the most widely prescribed medicines since the 1850's.<sup>3,4</sup> When the Marijuana Tax Act of 1937 was enacted, and CBD was removed from the human diet, endocannabinoid deficiency began to develop.<sup>3</sup> However, in addition to cannabis, other plants, such as black pepper, turmeric, ginger, green tea, hops, cacao, echinacea, flax seed, black truffles, helichrysum, liverwort, Chinese Labrador (rhododendron)

and marigold contain phytocannabinoids, which meet this deficiency.<sup>1</sup>

Endocannabinoids are depleted with stress, and can be supplemented by phytocannabinoids to support endocannabinoid functions.<sup>1</sup> Therefore, CBD is not an essential nutrient, even though, per se, it has often been turned to in times of stress.

CBD is readily obtainable in most parts of the United States and has been found to be a ready delivery system to facilitate activity of the ECS. All 50 states have laws legalizing CBD with varying degrees of restriction. According to a survey of 800 chiropractors, 26% of chiropractors in the US sell CBD products in their offices.<sup>2</sup>

Some of the strongest scientific evidence for the effectiveness of CBD is in treating childhood epilepsy syndromes, such as Dravet syndrome and Lennox-Gastaut syndrome, which typically do not respond to anti-seizure medications.<sup>4</sup> In some studies, CBD was able to reduce the number of seizures, and in some cases it was able to stop them altogether.<sup>4,5</sup>

The effects of the use of CBD products in the autistic population that have been observed and reported by parents include better focus, reduced hypersensitivity, better social interactions, improved behavior during transitions, better sleep and improved digestion and elimination. It is thought that the modulating effects of cannabinoids are responsible for a wide variety of responses.<sup>1</sup>

Allergy can be a reason to avoid CBD preparations in favor of other sources of phytocannabinoids. Since cannabis is a flower, those individuals with flower allergies should approach use of CBD products cautiously.

Dosing is a special concern. In this author's experience treating special needs children, it has been observed that beginning with very small doses and working up as needed often results in a unique dose for each patient. It is not uncommon to begin with doses as small as 1/20 of a ml, which, for many preparations of full spectrum CBD products, can be as little as .8 mg of CBD. These small doses are often enough to affect a pronounced change in a child on

the autism spectrum.<sup>6</sup> There have been anecdotal reports concerning dosage thresholds and potential adverse events so it is very important to practice cautious graded administration and careful monitoring of patient response.

A helpful resource to assist with dosing, available research and product choice is the Realm of Caring.<sup>7</sup> The Realm of Caring is involved in funding and conducting cannabis research in an effort to learn more about cannabis and its effects while legitimizing the therapy. Education empowers consumers to select the best products for their individual needs and informs healthcare professionals about options for their patients.

In summary, when choosing a CBD product, be sure it is

- Organic and GMO-free
- Full Spectrum and not a CBD isolate
- Certified by the US Hemp Authority: [www.ushempauthority.org](http://www.ushempauthority.org)
- Free of artificial ingredients such as sweeteners, colors and flavors

- From a reputable source that offers full disclosure regarding ingredients
- Consider potential side effects and allergies

Many families currently use CBD products with their special needs children and are seeing positive results. The chiropractor can be the front line resource for providing factual information and product sourcing and utilization for these families.

#### **Acknowledgement**

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#### **Keywords**

Endocannabinoid, CBD, THC, Chiropractic, hemp, cannabis, autism, inflammation, pain.

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# Development of an outcome assessment instrument for suboptimal breastfeeding in infants with musculoskeletal dysfunction

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## ABSTRACT

**Objectives:** 1) to develop an outcome assessment instrument for suboptimal breastfeeding, the Musculoskeletal Infant Breastfeeding Assessment Questionnaire (MIBAQ); and 2) to collect preliminary data on short-term breastfeeding outcomes of infants receiving chiropractic care. **Methods:** This descriptive cohort study was conducted in chiropractic offices using practice-based research methods. Participating Doctors of Chiropractic (DC) all reported frequently providing chiropractic care to infants with musculoskeletal imbalances accompanied by suboptimal breastfeeding. Their staff collected and transmitted data electronically to the central site. Participants were mothers of breastfeeding infants < 6 months of age first presenting for nursing dysfunction during the study period. Data forms were a brief focused history, pre-MIBAQ, one-week post-MIBAQ and patient disposition. MIBAQ content was based on published observer-based questionnaires. The post-form included the Patient's Global Impression of change (PGIC). The MIBAQ consisted of 23 questions about suckling-related symptoms using a 4-point Likert scale. Responses were summed for a total score (0-69). Pre- and post-scores were compared using a paired t-test. The Pearson correlation between the change score and the PGIC was also calculated. **Results:** From May 15 through August 15, 2019, data were collected from 94 participants in 10 chiropractic offices; 100% collected the pre-MIBAQ and 81% the post-MIBAQ. Infants' mean age was 51 days. The difference between the mean pre-MIBAQ score (23.5) and post-(one-week) MIBAQ score (17.1) was highly significant ( $p < .000$ ), as was the correlation between the change score (6.4 points) and the PGIC (76% reported improvement; Pearson correlation = .562). **Conclusion:** The MIBAQ appears to be a feasible instrument for use in chiropractic practices, and correlates highly with the PGIC, an established general outcome measure.

## Introduction

Authorities worldwide strongly recommend exclusively breastfeed for infants' first six months,<sup>1,4</sup> and the World Health Organization further recommends that breastfeeding should continue, along with age-appropriate foods, to at least two years of age.<sup>5</sup> Anything less than these intervals is termed suboptimal breastfeeding.<sup>1,6</sup> The 2015 United States Centers for Disease Control and Prevention statistics show that although 83% of infants started life breastfeeding, only 25% were exclusively breastfed at six months and by the age of 12 months, only 36% were breastfed at all.<sup>7,8</sup>

Why is this the case, when it is universally acknowledged that "breast is best" for both infant and mother?<sup>1,2,4,6,7</sup> Many complex factors contribute to suboptimal breastfeeding, and public health agencies address factors at the community level and policy level.<sup>9</sup> Healthcare providers such as

physicians, nurses, chiropractors and lactation counselors, who work directly with patients/clients, are advised by authorities such as the U.S. Preventive Services Task Force (USPSTF) to counsel new parents and provide them with information to encourage breastfeeding.<sup>3</sup>

## Musculoskeletal factors

Although the biomechanics and physiology of infants' suckling are known,<sup>10-12</sup> until fairly recently there has been a lack of emphasis on correcting musculoskeletal and/or biomechanical factors present in the infant which might interfere with successful breastfeeding, possibly due to the primary practitioner not recognizing them.<sup>13</sup> This is changing, with providers in medicine, osteopathic medicine, nursing, lactation counseling, chiropractic and dentistry beginning to explore the role of infant musculoskeletal issues in breastfeeding.

This includes not only biomechanical factors such as the mother properly positioning the infant,<sup>14</sup> but also musculoskeletal issues in the infant which interfere with the biomechanics of breastfeeding. The biomedical literature is increasing its attention to soft tissue dysfunctions such as ankyloglossia (tongue-tie),<sup>15</sup> which is often treated surgically and has been found to improve the infant's ability to nurse successfully.<sup>15-18</sup>

However, little discussion is focused around differentiating the structural and functional components of ankyloglossia. The symptoms of tongue-tie and musculoskeletal dysfunction are similar because both create biomechanical alterations that result in similar symptoms. Normal anatomic variations of frenula coupled with compensatory musculoskeletal dysfunction also create issues that can lead to biomechanical alterations resulting in confounding symptoms complicating cases even further. Ruling out musculoskeletal issues such as TMJ dysfunction, myofascial tension involved in turning the head and sucking, segmental dysfunction and cranial asymmetries are important factors in cases of suboptimal breastfeeding to ensure proper breastfeeding biomechanics and differential diagnosis for proper treatment.

A recent scoping review found moderate-strength, favorable evidence, based on the GRADE criteria,<sup>19</sup> for the effectiveness of manual therapy, including chiropractic and osteopathic manipulation and soft tissue therapies, on suboptimal breastfeeding.<sup>20</sup> Because this evidence is still emergent, manual interventions which might improve infants' ability to nurse effectively do not appear to be included in current guidelines. Since the existing evidence is promising, it is important that further research be conducted. To date, there has only been one randomized controlled trial (RCT) on the topic, in which osteopathic manipulation and soft tissue therapy, accompanied by lactation consultation, were found to improve infants' latching ability immediately post-treatment.<sup>21</sup>

In this RCT, as well as other studies, such as case reports and case series, the assessment tools for breastfeeding success have been observer-based, conducted by a trained observer such as the lactation consultant.<sup>22</sup> These are not practical for widespread use in private practice, and most of the research done on the use of manual therapy for infants with suboptimal breastfeeding has been done in private chiropractic offices.<sup>20</sup> Therefore, the purpose of this project was to develop a user-friendly and valid outcome assessment instrument for suboptimal breastfeeding that will facilitate data collection on a broader scale.

## Methods

This was an observational cohort study conducted in a number of chiropractic clinics in the U.S., using the meth-

ods of practice-based research (PBR).<sup>23-25</sup> PBR is a well-established method for collecting observational data from multiple clinical practices.<sup>26</sup>

The lead institution's Institutional Review Board approved the project prior to any data collection. Clinic participation was a sample of convenience. The investigators invited Doctors of Chiropractic (DCs) who they knew had experience in treating infants with suboptimal breastfeeding. Practitioners who agreed to participate were given detailed instructions for their staff to collect data, including administering informed consent to participating mothers and de-identifying all data transmitted to the lead institution's central office. Data were collected directly from the mothers of the treated infants, and from the treating DCs.

The lead institution's Institutional Review Board approved the project prior to any data collection.

## Eligibility criteria

*Inclusion criteria:* consecutively presenting mothers of currently breastfeeding infants age  $\leq 6$  months who bring their infant for care at a participating clinic in the study period.

*Exclusion criteria:* Mother declines to participate (that is, declines to fill out the forms).

## Data collection

The participating offices collected all data on site using paper forms. The mothers completed three of the four forms and the treating clinician completed one form. The office identified each case with a pre-assigned identification number and did not include any personal identifiers. The office staff transmitted the forms electronically (scanned and emailed) to the central office.

*Data collection period.* One set of data was collected at the time of the infant's first visit, prior to treatment. The other set was collected one week after the first visit, at a subsequent visit. We chose this interval because, based on the investigators' clinical experience, some improvement would likely be apparent at one week, and it would be unlikely that the infant would already be discharged at that time. One of the key barriers to collecting follow-up data in PBR is attrition: it is extremely difficult to get complete follow-up once patients have completed a course of care.<sup>23</sup> Since our purpose was only to test the sensitivity of the instrument to clinical change, and not to evaluate final treatment outcomes, we chose a one-week treatment interval to minimize attrition.

## Form administration

At the first visit:

1. History form completed by the mother: infant age, sex

and history of use of lactation consultant, presence of tongue-tie and related medical treatment.

2. Pre-MIBAQ form (Musculoskeletal Infant Breastfeeding Assessment Questionnaire; see description below) completed by mother.

At visit approximately one week from the first visit:

1. Post-MIBAQ form completed by mother.  
2. Disposition form completed by treating DC, including 1) number of visits to date; 2) discharge status; 3) treatment procedures used. We left it to the doctors' interpretation of the techniques they used, so these should not be construed to indicate specific certification or training beyond basic chiropractic scope of practice.

### Outcome measures

*MIBAQ form (Musculoskeletal Infant Breastfeeding Assessment Questionnaire)*

We developed the MIBAQ based on a) relevant question-

Domain	Items
Latching <sup>25,26,28</sup>	1. Slips off nipple 2. Chews/bites nipple 3. Latches on tip of nipple only 4. Pulls at nipple while nursing 5. Painful nipples due to baby not latching properly 6. Can't open mouth widely
Sucking <sup>25-28</sup>	7. Starts and stops nursing during a feeding 8. Falls asleep during feeding 9. Sucking sounds are not regular (start and stop) 10. Whistling sounds (intake of air) while nursing 11. Sucking is weak 12. Does not empty breast
Swallowing <sup>28</sup>	13. Milk spills out of mouth or chokes on milk while nursing 14. Chokes or gags on milk while nursing 15. Clicking sound while swallowing 16. Excessive gas, burping spitting up
Symmetry <sup>24</sup>	17. Difficulty latching on one breast more than the other 18. Turns head to one side more frequently or more easily 19. Head/face has irregular shape from one side to the other
Global <sup>24</sup>	20. Wants to nurse almost constantly 21. Restless sleep 22. Excessive crying 23. Not gaining weight adequately

**Table 1. MIBAQ Domains.**

naires published in the literature<sup>22,27-31</sup> and b) the investigators' clinical experience.<sup>32-34</sup> We identified four domains related directed to the mechanics of nursing (latching, sucking, swallowing, and symmetry) and one global domain. Table 1 lists the domains and associated items.

The MIBAQ consisted of 23 items using a Likert scale of 0-3, where 0=never or seldom; 1= sometimes; 2=often; 3=very often or always. The pre- and post-forms were identical except that the Patient Global Impression of Change was included in the post-MIBAQ. We took a conservative approach to scoring, imputing all missing values as 0, which would indicate that the symptom was never/seldom present.

*PGIC (Patient Global Impression of Change) form*

We included the Patient's Global Impression of Change (PGIC) scale in the post-assessment as a comparison measure to assess the MIBAQ's sensitivity to clinical change. The PGIC is a valid and reliable measure of patient-reported clinical change used widely throughout healthcare research and practice due to its simplicity and responsiveness.<sup>35,36</sup> Furthermore, it is administered at a treatment endpoint only, not at baseline, making it even easier to use. It is suggested that it be combined with domain-specific items as well. It consists of a 7-item Likert scale, where patients indicates how much their (condition or symptom) has improved since they started treatment, with 7=very much better, 6=much better, 5=a little better, 4=no change, 3=a little worse, 2=much worse and 1=very much worse. We adapted the PGIC for this study to read: Check the box for how your baby's breastfeeding is now, compared to before treatment at this office.

### Data management and analysis

The participating offices transmitted the de-identified forms electronically to the central office. They were key-entered into Excel databases and imported to SPSS (v.26) for cleaning and verification. We computed descriptive statistics for demographic and history variables. We computed total MIBAQ scores by summing all 23 items' responses; the possible range would be 0-69, with lower scores indicating fewer symptoms of nursing dysfunction. We then compared total pre- and post-MIBAQ scores using a paired t-test. We compared the change score (difference between mean pre- and post-MIBAQ total scores) to the mean PGIC score using a Pearson correlation.

### Results

#### *Sample characteristics*

Ten participating DC offices collected baseline data from 94 mothers. The mean number of participants per office was nine, but the median was six (minimum, 1; maximum 35). Two offices collected the majority of the data (64%). We had demographic data on 93 infants (one form was not complet-

ed). Infants' mean age was 51 days and the median was 40 (range 1-184 days). The infants were fairly evenly divided between boys and girls, with 52% boys. Eighty-three percent (77) of the mothers had consulted a lactation consultant. Of these, 73% were still seeing the lactation consultant; the mean number of visits was three, median two (range 1-22). Seventy-six percent of the infant had a tongue, lip or buccal tie, and of those, 63% had received medical treatment (see Table 2 for details).

	n	%
Reported history of tongue, lip or buccal tie	71	76
Infant received medical treatment for tie (n=71)	45	63
<b>Type of treatment reported</b>		
Surgical	39	55
Manual therapy (unspecified)	19	27
Exercises (unspecified)	19	27
Other (unspecified)	1	1

**Table 2. Participants reporting infants' history of tongue, lip or buccal tie (n=71; 76% of total sample of 94).**

**Follow-up and treatment**

Seventy-six of the 94 participants (81%) completed the one-week follow-up. Doctors completed 100% of the discharge forms. For the 18 participants who did not do the follow-up, the doctors reported the reasons for dropping out for 17: 10 (59%) did not return for treatment and for seven (41%), the office forgot to give them the form. The number of treatment visits prior to the one-week post-MIBAQ was reported for 77 (82%) of participants. The mean number of visits in the one-week interval was 2.5 (median=2; range 1-7). Doctors reported that 63% of infants were not discharged at one week, although for 22%, this question was left blank. For the 63% not discharged, the most common reasons given by the doctor were: nursing issues improve but not resolved (66%) and nursing issues resolved but infant needs treatment for other issues (19%). All reasons are listed in Table 3.

Reason reported by participating DC	n	%
Nursing issues improved but not resolved.	39	66
Nursing issues resolved but baby needs treatment for other issues.	11	19
Nursing issues are the same and need more treatment.	5	9
Missing (left blank)	2	3
Nursing issues are worse and need a different treatment plan.	1	2
Baby was not improving and needed referral for another type of care.	1	2
Total	59	100

**Table 3. Reasons infants were still under care at one week (n=59).**

The participating DCs reported that cranial (88%) and cervical (78%) were the areas they most commonly treated,

follow by thoracic (42%) and lumbar (27%). The most commonly reported manual procedure were craniosacral (82%) and soft tissue (69%). All procedures are listed in Table 4.

Procedure	n	%
Craniosacral	77	82
Soft tissue	65	69
Modified diversified	44	47
Manual therapy, unspecified	35	37
Instrument-assisted	3	3

**Table 4. Manual therapy procedures reported by participating DCs with study infants (n=94).**

**Outcomes**

The baseline (pre-) MIBAQ scores for all 94 participants are shown in Table 5 (following page). The scores are displayed by the percent of participants responding "never or seldom," to illustrate which questions were likely to be irrelevant to the outcomes. There were five items for which > 50% of mothers responded "never or seldom."

*Comparison of pre- to post-MIBAQ scores*

Table 6 (see page 1623) details the scores of the 76 participants who had both pre- and post-MIBAQ scores. There were five items with >50% of participants marking "never or seldom" in the pre-MIBAQ.

The mean total pre-MIBAQ score was 24.5 (possible range of 0-69) and mean total post-MIBAQ score was 17.1. The difference between these (6.4 points) was highly statistically significant (p< .001). Table 7 (following page) presents the details of the comparison.

*Correlation of PGIC and MIBAQ*

The PGIC scores (see Table 8 following page) indicate that 76% of mothers reported improvement in their infant's breastfeeding in the one-week treatment period. The PGIC score was highly significantly correlated (=.539, p< 0.01) with the change in the MIBAQ scores from pre- to post.

**Discussion**

The MIBAQ appears to be a feasible instrument to use in chiropractic clinical practice. The participating DCs achieved 100% follow-up with the discharge form, although over 20% did not fill out all the items on the form. For the participating mothers, 81% completed both the pre- and post-form. The doctors identified the reason for incomplete follow up by the participating mothers for 17 of the 18 lost to follow-up: for 59%, it was because she did not return at one week and in 41% of cases, the office forgot to administer the form. This means that the office failed to administer the post-MIBAQ for only 7 of 94 cases, which is a very low failure rate. Similarly, a follow-up rate with the participants of 81% is considered adequate, being high enough to minimize attrition bias.<sup>37</sup>

Domain	Infant's actions	Pre-MIBAQ % (n=94)			
		N	S	O	A
Symmetry	Q19 Head/face irregular shape on one side	83	10	1	6
Global	Q23 Not gaining weight adequately	71	13	7	9
Global	Q22 Excessive crying	64	31	5	0
Sucking	Q10 Whistling sound (intake of air) while nursing	62	20	13	4
Sucking	Q11 Sucking is weak	59	26	12	4
Latching	Q04 Nipple is sore, blistered or cracked	44	29	16	12
Swallowing	Q15 Makes clicking sound while nursing	44	29	15	13
Global	Q21 Restless sleep	44	39	14	3
Swallowing	Q14 Chokes or gags on milk when nursing	40	34	14	12
Swallowing	Q13 Milk spills out of mouth while nursing	34	38	23	5
Global	Q20 Wants to nurse almost constantly	34	40	18	7
Latching	Q03 Bites or chomps on nipple	33	44	11	13
Latching	Q05 Pulls at nipple while nursing	33	44	15	9
Sucking	Q09 Sucking sounds not rhythmic	33	36	18	13
Symmetry	Q17 Difficulty latching on one breast more than other	33	30	16	21
Sucking	Q12 Does not empty the breast at each feeding	28	37	23	13
Latching	Q06 Can't open mouth widely	27	27	27	20
Swallowing	Q16 Excessive gas, burping, spitting up	26	27	23	25
Latching	Q01 Slips off nipple	25	45	22	9
Symmetry	Q18 Turns head to one side more frequently/easily	25	26	18	32
Latching	Q02 Latches on the tip of nipple area only	23	39	28	10
Sucking	Q07 Starts and stops nursing during a feeding	9	29	38	25
Sucking	Q08 Falls asleep during feeding	7	30	40	22

**Table 5. Baseline MIBAQ scores by highest number of “never or seldom” responses (n=94)**  
 N=Never or seldom; S=Sometimes; O=Often; A=Always or very often

	Mean	SD	SE Mean	95% CI of difference		Sig (2-tailed)
				Lower	Upper	
Pre-MIBAQ1 — Post-MIBAQ	6.4	8.06	92	4.51	8.20	.000

**Table 7. Comparison of mean total MIBAQ scores at baseline and one week (n=76).**  
 SD, Standard Deviation; SE, Standard Error; CI, Confidence Interval; Sig, significance

Very much better	Much better	A little better	No change	A little worse	Much worse	Very much worse
7	6	5	4	3	2	1
4%	25%	47%	19%	4%	0%	0%

**Table 8. Patient Global Impression of Change (PGIC) scores (n=68).**  
 Participant indicated how her baby’s breastfeeding is now, compared to before treatment at this office.  
 Scale completed at one week from baseline.  
 Pearson’s correlation (2-tailed) to MIBAQ change score=.539, significant at the 0.01 level

Domain and Infant's actions	Pre-MIBAQ %				Post-MIBAQ %			
	N	S	O	A	N	S	O	A
<b>Latching</b>								
Slips off nipple	26	45	22	7	36	47	16	1
Latches on the tip of nipple area only	20	45	28	9	37	47	13	3
Bites or chomps on nipple	32	46	11	12	53	36	7	4
Nipple is sore, blistered or cracked	43	32	15	11	57	25	9	9
Pulls at nipple while nursing	33	42	18	7	33	50	12	5
Can't open mouth widely	26	28	26	20	29	49	17	5
<b>Sucking</b>	<b>N</b>	<b>S</b>	<b>O</b>	<b>A</b>	<b>N</b>	<b>S</b>	<b>O</b>	<b>A</b>
Starts and stops nursing during a feeding	8	29	40	24	21	40	25	15
Falls asleep during feeding	7	33	38	22	9	49	28	15
Sucking sounds not rhythmic	36	33	18	13	49	34	12	5
Whistling sound while nursing	58	22	15	4	70	24	5	1
Sucking is weak	59	26	11	4	67	24	5	1
Does not empty the breast at each feeding	30	38	22	9	38	39	17	5
<b>Swallowing</b>	<b>N</b>	<b>S</b>	<b>O</b>	<b>A</b>	<b>N</b>	<b>S</b>	<b>O</b>	<b>A</b>
Milk spills out of mouth while nursing	32	40	21	7	40	45	8	7
Chokes or gags on milk when nursing	40	37	12	12	43	42	13	1
Makes clicking sound while nursing	43	29	15	13	57	30	7	7
Excessive gas, burping, spitting up	28	26	24	22	3	36	22	11
<b>Symmetry</b>	<b>N</b>	<b>S</b>	<b>O</b>	<b>A</b>	<b>N</b>	<b>S</b>	<b>O</b>	<b>A</b>
Difficulty latching on one breast more than other	37	32	15	17	55	32	9	4
Turns head to one side more frequently/easily	29	25	20	26	33	43	15	9
Head/face irregular shape on one side	87	5	1	7	87	8	4	1
<b>Global</b>	<b>N</b>	<b>S</b>	<b>O</b>	<b>A</b>	<b>N</b>	<b>S</b>	<b>O</b>	<b>A</b>
Wants to nurse almost constantly	37	40	17	7	43	46	7	4
Restless sleep	42	40	15	4	53	37	9	1
Excessive crying	65	33	3	0	65	32	3	1
Not gaining weight adequately	72	11	7	11	80	15	3	3

**Table 6. Comparison of pre- and post-MIBAQ scores (n=76).**  
**Percentages are rounded to the nearest whole number.**  
**N=Seldom or never; S=Sometimes; O=Often; A=Always or very often**

The MIBAQ also appears to be sensitive to clinical change. Pre- to post-changes were significantly correlated to the PGIC, which is a reliable, valid and clinically sensitive outcome measure.<sup>35,36</sup> Furthermore, the MIBAQ provides condition-specific detail, while the PGIC is a global measure, and it is recommended that the PGIC be combined with measures for specific factors.<sup>35,36</sup>

It is likely that the MIBAQ could be streamlined to include fewer questions; in this study, we noted five questions for which > 50% participants marked “never or seldom” at baseline, indicating that the item was either non-relevant, or they didn't understand what it meant. However, since this study's sample is not necessarily representative of all chi-

ropractic or other health care providers' practices, it would take a larger and more representative sample to conduct a factor analysis to consolidate the items in the MIBAQ. A shorter questionnaire that did not lose its clinical sensitivity would be preferable, if possible. Its reliability should also be assessed in future, larger studies. The PGIC, which we used to assess the validity of the MIBAQ, is a general measure which may be helpful to adopt as well.

#### **Limitations**

The chief limitation of this study was that our sample was likely not representative of DC practice, since it was a sample of convenience, with two of the doctors contributing 64% of the participants. Even with this limitation, we were

able to demonstrate that the MIBAQ is sensitive to patient-reported (in this case, proxy-patients) change.

Another limitation, although without bearing on the primary purpose of the study, was the short time frame for follow-up. We chose it in order to minimize attrition, which was successful. However, it is interesting that over one third (37%) of infants were discharged at one week, and that two thirds (76%) of infants had some degree of improvement within that period of time. Future studies should be planned to follow infants all the way to discharge, to obtain complete information on course of care as well as final outcomes rather than interim outcomes.

A large majority (76%) of mothers in this study reported that their infant had a tongue, lip or buccal tie, and of those, 63% had received medical treatment. Because tongue-tie was not the focus of the study, these data are limited by the lack of more detailed information on this finding and by the fact that the sample size was not large enough to do a sub-analysis of infants that had had the procedure compared to those that had not.

The small sample size also precluded subanalyses by other demographics, particularly the infants' age. Primary breastfeeding issues thus could not be differentiated from those arising after the neonatal period. However, this was not the purpose of this study, and the age range of 0-6 months was adequate for the initial assessment of the MIBAQ instrument.

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# Primary monosymptomatic nocturnal enuresis: can chiropractors handle this? An evidence-based case report

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## ABSTRACT

A case report of an eight-year-old child suffering from persistent nocturnal enuresis investigated different therapies for primary monosymptomatic nocturnal enuresis and the efficacy of chiropractic management. Slight improvements were noted after a short trial of chiropractic therapy.

**Key words:** pediatric, chiropractic, enuresis, case report.

### Introduction

Attainment of bladder control is considered a major milestone in a child's development but attaining this milestone is not always accomplished on the anticipated timeline. Nocturnal enuresis (NE) is defined by the International Children's Continence Society as involuntary loss of urine at night, in the absence of an underlying pathology, at an age where a child is supposed to be dry. By consensus, the age of five has been set as the upper limit for being dry.<sup>1,2</sup>

The genetic factors are key in the etiology of NE. A family history of NE increases the risk with up to 77% of NE occurring in the parents.<sup>3</sup> This finding could suggest that the child will get over it at the same age as the parent(s) did.<sup>3</sup>

Incessant nocturnal enuresis is not only socially disruptive but it is also a stressful condition which affects the whole family. It not only causes frustration and embarrassment for parents and child but also has an impact on the child's psychological situation. In most cases, the child may feel different from others, does not want to participate in school trips or sleepovers and is fearful that someone will discover their problem. This results in emotional distress and low self-esteem which has a negative impact on the child's health and well-being.<sup>4,5,6</sup>

The nocturnal enuresis in this case report is about primary monosymptomatic enuresis, meaning that the patient had never been dry for longer than six months and had no underlying pathologies causing the incontinence.<sup>7</sup>

### Case Report

An eight-year-old girl was presented by her mother to a chiropractic clinic seeking help for persistent nighttime bedwetting. The patient reported that she had never been dry during the night. She denied any history of major falls,

trauma or accidents. Even though she denied experiencing any back pain, the patient mentioned that she regularly had headaches and experience car sickness easily. Further questioning revealed a difficult birth history, symptoms of colic and difficulties with attachment during breastfeeding, which eventually resolved with time.

The mother reported that her daughter was not taking any responsibility for the recommended steps to reduce her persistent bedwetting. She said that her daughter was not drinking enough during the day and did not regularly void before bedtime. Her frequent after school activities made it difficult for the family to eat dinner early. However, they were trying to restrict drinking for two hours before bedtime. The mother reported not having had any history of enuresis herself, but was not sure whether there was a history of enuresis on father's side.

The patient had sought advice from her general practitioner and from the school nurse. In consultation with the nurse, a bed alarm had been tried twice for several weeks without any change. Both the GP and the school nurse reassured the mother that her daughter would grow out of it. Apart from limiting drinking before bedtime, encouragement to hydrate well during the day, requiring the child to go more often to the toilet and using a bed alarm, no other interventions were implemented.

### Clinical findings

Clinical examination revealed rotational restrictions in the cervical spine, a restriction at L4-L5 as well as excess tension in the right sternocleidomastoid and bilateral upper trapezius. Significant muscle spasms and stiffness were noted throughout her spine and the right sacroiliac joint was restricted. Internal rotation of the right hip was reduced. The girl was ticklish and exhibited a retained Perez reflex.

## Method

A search was conducted to identify research material relevant to the treatment of nocturnal enuresis and whether chiropractic therapy had proven efficacy. This was done using the Cochrane Database, Pedro, Pubmed and Medline. The first search was conducted to find out the current approaches used to treat primary nocturnal enuresis using the keywords nocturnal enuresis, monosymptomatic, child and management. The second search was conducted to find out whether chiropractic had demonstrated any influence in cases of persistent enuresis. This was done using the keywords nocturnal enuresis and chiropractic. In total, 20 articles were retrieved. Additionally, chapters in two books were reviewed.

## Discussion

A single etiology for the persistent bedwetting child is unknown and even more unlikely. Over time healthcare professionals have tried to determine an efficacious approach to treat this particular condition. Several studies have looked at the current research and how different approaches were tried to find the best treatment for the bedwetting child. But which one is now the best? Can chiropractors solve this issue? Several categories of treatment are regularly applied.

*Behavioral interventions* — This term includes the following approaches: restricting fluids before bedtime, the lifting technique (children are taken out of bed while asleep and put on the toilet), reward systems and bed alarms. The best known, least invasive and most sustainable current treatment option is a bed alarm. This is a technique where a pad is placed either in the pants of the child or on the mattress. The pad detects when the child is urinating and either a bell, a vibration or a light signal occurs. Unfortunately, the demanding nature of this therapy, meaning the alarm should be worn every night and requires the parents to actually made their children aware when the alarm goes off, results in low compliance and high dropout rates.<sup>2,8</sup>

Another anti-enuretic but controversial strategy is lifting. This means the parents pick up their sleeping child out of bed and put him or her on the toilet. This can be done either in silence or the parent can ask the child to tell them the pre-agreed password so they are sure the child is aware that he or she has to go the toilet. The concern here is that this technique encourages the child to pass urine while asleep. The criticism of this technique is that it does not encourage the child to learn to wake when the bladder is full.<sup>5,9</sup> The study by Van Dommelen and colleagues<sup>9</sup> revealed that despite that criticism, children eventually remain dry with this technique. Furthermore, lifting the child to the toilet without the use of a password resulted in better outcomes than lifting with a password. The long-term effect has also been that 78% of the children were still dry three years after the intervention took place. Although this study included

children younger than five years of age, the results are still credible as fewer children (69%) in the control group were dry at follow-up but further critical analysis is warranted.<sup>9</sup> For example, lifting was done by different parents and without any objective control meaning the researchers are not sure whether the technique was done correctly and consistently.

The most recent investigation into behavioral interventions for nocturnal enuresis reveals the complexity of the condition.<sup>4</sup> The authors concluded that the same strategies used to overcome bedwetting at 7½ years old were not always effective in correcting enuresis at 9 ½ years old.<sup>4</sup> However, this study was of poor quality as it did not differentiate between monosymptomatic or non-monosymptomatic bedwetting. Ultimately what the authors concluded was that every case was different, that parents should seek advice and that the choice of treatment depended on the subtype of enuresis, the severity of the case and the motivation of parents and child to solve the issue(s).<sup>3,4,10</sup>

*Are medications effective treatment for primary nocturnal enuresis?* — Opinions are divided and caution around the use of medications with children is an issue. The most well-known drug for treating nocturnal enuresis is desmopressin. Glazener and Evans<sup>11</sup> concluded that the utilization of desmopressin is twice as likely to achieve 14 consecutive dry nights compared to no active treatment or placebo. Unfortunately, they also found that once the therapy has ended, the effect of desmopressin was not sustainable and relapse rates were high.<sup>6,11</sup> A problem with interpreting similar pharmaceutical related findings was that several included studies in this review were quasi-randomized, included children younger than five, failed at reporting how the data was obtained and few studies included follow-up. A 2005 review<sup>12</sup> found that drugs showed a quicker onset of action, especially desmopressin,<sup>13</sup> than an enuresis alarm. It also related that both interventions are still frequently prescribed. Another drug trialed was a tricyclic, which showed improvement compared to absence of treatment or “doing nothing.” There has been debate as to whether tricyclics should be used alone or in combination with another tricyclic or anticholinergic drug.<sup>12</sup> Some suggest that if imipramine is combined with oxybutynin, the outcomes are more efficacious than imipramine used on its own.<sup>8,14</sup> However, it has been shown that the combination of imipramine with desmopressin did not give better outcomes than the imipramine monotherapy.<sup>8</sup> It was not specified which type of cases for which either combination therapy or monotherapy should be chosen.<sup>15</sup>

Further, almost all reviews about the effect of drugs for bedwetting were of poor quality. The possibility of an underlying organic disease or daytime bedwetting could not always have been excluded which could have biased the result; trials had small populations and baseline bedwetting

was not consistently measured.<sup>8,14,15</sup>

Overall, all the cited researchers agreed that the use of drugs to combat nocturnal enuresis have had adverse effects occur such as liver and heart problems, seizures and gastrointestinal issues.<sup>8</sup> Therefore, it has been recommended to only use them episodically and preferably in combination with behavioral interventions.<sup>12,13</sup>

*Complementary or Alternative treatment options* — Usually when the classic medical interventions fails, parents seek help from CAM (complementary and alternative medicine) healthcare professionals. This may include acupuncture, homeopathy, hypnosis, chiropractic, dietary advice or counselling therapy.<sup>16</sup> A Cochrane review investigated 24 randomized controlled trials, in which 1,283 children received a complementary intervention. They found that subjects who underwent chiropractic treatment resulted in less enuresis post-treatment.<sup>16</sup> Their finding confirmed that of Van Poecke and Cunliffe.<sup>17</sup> Their case series found a 66.6% response rate to chiropractic therapy which was significantly higher than the natural remission rate of 15%.<sup>17</sup> Acupuncture also seemed to have slightly better outcomes than tricyclics.<sup>16</sup> There was insufficient evidence for homeopathy, surgery or dietary interventions. However, these findings should be interpreted carefully. The review concluded that the included articles were of poor quality, lacking follow-up data and the baseline comparability of half of the trials was doubtful. Therefore, the claims any of the previously mentioned alternative therapies are useful in the treatment of primary nocturnal enuresis are not sufficiently substantiated.<sup>16</sup>

*Biological plausibility* — Although there is not a consensus as to whether chiropractic treatment could help or not, there may be biological plausibility from an neuroanatomic perspective.<sup>18</sup> The autonomic regulation of the bladder shows teamwork between the voluntary and the visceral motor system which consists of the sympathetic and parasympathetic division. Both divisions find their origin within the spinal cord, the sympathetic division at T10-L2 and the parasympathetic at S2-S4. Contraction of the sphincter also originates within the sacral spinal cord segments (S2-S4). Spinal manipulation of these levels could influence the afferent and efferent function of the bladder and thus chiropractic treatment might be indicated.<sup>18,19</sup>

*Retained primitive reflex* — To survive the change from the quiet, protective womb to an overwhelming world of sensory stimuli, the child is equipped with primitive reflexes. These are not only essential for surviving the first weeks of life but they also provide a basis for later voluntary skills. Prolonged primitive reflex activity is said to be a lack of neurologic maturation within the central nervous system and may also prevent the development of postural reflex-

es.<sup>20</sup> An important reflex that can be related to (involuntary) urination is the Perez or Pulgar Marx reflex.<sup>20</sup> This reflex is elicited when both sides of the spine are stroked simultaneously from neck to pelvis. The response involves flexion of both legs, elevation of the pelvis, lifting of the head, emptying of the bladder and increased bowel movements. The Pulgar Marx reflex should be inhibited by two to three months of age.<sup>20</sup> It is found that many children who wet the bed after the age of five have a retained Perez reflex.<sup>20</sup> Some research suggests that regular massage of the back could reduce this reflex.<sup>20,21</sup>

*Aims for the future* — Future trials should aim for more uniformity in outcome measures using mean number of wet nights after treatment along with long-term follow-up data, up to at least a year post-treatment. Studies, preferably randomized controlled trials, should also clearly distinguish between monosymptomatic and non-monosymptomatic nocturnal wetting and should exclude any organic cause of the enuresis.

### Applying the evidence

This family had tried several treatments before presenting to the chiropractor, without improvement. After the anamnesis and the examination procedures, the parents were informed that the articular and myofascial restrictions identified could possibly be consistent with the persistent bedwetting their child experiences (biological plausibility and retained reflex). They were informed with the current research which said that chiropractic treatment was safe<sup>22</sup> but unknown whether it could help with incessant nocturnal enuresis.<sup>18</sup> Therefore, I could only recommend a short therapeutic trial to determine whether chiropractic care would be helpful or not in this particular case.

The parents consented to a trial of chiropractic treatment. After two treatments, two dry nights were reported and the child had not experienced any headaches or car sickness since receiving those two treatments. Unfortunately, after the third treatment the girl had wet the bed every night again, possibly because other levels were adjusted compared to the first and second treatment or the dry nights were due to the Hawthorne effect (when the patient modifies their behavior in response to the fact that her parents were watching her) which modified the results. The therapy on the fourth, fifth and sixth appointment consisted of manipulation of exactly the same levels as during treatment one and two. This was done because those first treatments resulted in some dry nights and if bedwetting occurred, a smaller amount of urine was noted. Again, on the fifth appointment one dry night was reported and it was mentioned that if wetting had occurred, the amount of urine had certainly reduced. Even though the same treatment was given for two more sessions no further improvement had been made. The mother nor the child herself reported

any adverse events during or after any of the treatments given. As the trial of seven treatments had ended, both the parents and I decided that further treatment would not be beneficial at this moment. They were convinced that their daughter had to take responsibility for drinking more during the day and that she should go to the toilet more regularly before a bigger improvement could take place. Although it did not completely resolve the problem, the parents were happy with the improvements as well as the fact that their daughter had had no recurrence of headaches or car sickness since the initial two visits.

## Conclusion

There was insufficient evidence to apply to this case, so I proceeded, with the parents' consent to treat the persistent bedwetting with chiropractic therapy in a therapeutic trial. As chiropractic manual therapy for children has been shown to be safe, a clinical trial to try to help this family was an appropriate way forward. Further research is required to find out whether chiropractic treatment can be helpful in cases of persistent nocturnal enuresis where no underlying pathology could cause the bedwetting.

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# What are the effects of vitamin D interactions on the developing musculoskeletal system?

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## ABSTRACT

**Introduction:** Vitamin D deficiency is a global public health issue and large health agencies encourage the use of vitamin D supplementation. Vitamin D is an essential hormone which is responsible for both musculoskeletal development and systemic health. The goal of this narrative review was to investigate the following clinical issues: 1) Impact of Vitamin D on the developing musculoskeletal system in the pediatric patient and the growing child's need for nutritional intake or supplementation, 2) Factors important to determine the need for supplementation and appropriate supplementation, 3) Risk for overdose of Vitamin D. **Methods:** Literature search of large search engines. Limits used: age 0-18 years, English language and published in the last 10 years. Key words used 'Vitamin D and pediatric', 'Vitamin D and development', 'Vitamin D and deficiency', 'Vitamin D and side effects'. **Results:** One Cochrane review, two global epidemiological reviews on nutritional rickets, six guidelines on Vitamin D supplementation, and several articles on vitamin D and musculoskeletal development were identified and considered in the study. The American Academy of Pediatrics and the Canadian Pediatric Society and European guidelines recommended 400 IU/day for infant - adolescent. The US Institute of Medicine and World Health Organization recommended adequate nutritional intake prior to supplementing children 0—1 and 1—18 years old with 400 and 600 IU/day, respectively. Clinicians must be aware of key points that would significantly affect the correct recommendation and supplementation of Vitamin D. These are history, anthropometric measurements, physical activity levels, dietary habits and sun exposure parameters to achieve optimal musculoskeletal results. **Conclusion:** At present, 400-600IU/day Vitamin D supplementation is the daily recommendation for pediatric population based on the global healthcare agencies. Understanding the great impact of vitamin D on the musculoskeletal system, future work must be done to examine the prophylactic use of vitamin D and its appropriate adapted supplementation.

## Introduction

World Health Organization (WHO), US Institute of Medicine (IOM), the Endocrine Society in the USA and the European guidelines acknowledge that vitamin D deficiency is a global public health issue and encourage the use of vitamin D, advising on supplementation and daily recommended dosage. Vitamin D is an essential hormone, which has attracted increasing attention in the last decades. It exists in two forms D3 -cholecalciferol and D2 or ergocalciferol.<sup>1</sup>

Vitamin D is unique as it is both absorbed via dietary intake, in the small intestine by chylomicrons or can be synthesized by an endogenous process.<sup>2</sup> The dual absorption mechanism highlights its importance. Correct absorption is thus subject to adequate nutritional intake. Fatty fish, fish liver oil, and egg yolks are typically good sources of Vitamin D2. Endogenous synthesis is the second way of producing and absorbing pre-vitamin D3.<sup>3</sup>

Sun UV exposure, (290—320 nm) interacts with 7-dehydrocholesterol and is absorbed in the skin. Factors influencing the effectiveness of this process are average skin exposure to sun light, color of skin and latitude of the country.<sup>4</sup> Both versions of Vitamin D (D2 and D3) are inactive until they

reach the liver, where the first hydroxylation happens and the following hydroxylation occurs in the kidney. The final product is the bioactive hormone, calcitriol. This is an important hormone as it dictates the homeostasis of several minerals (calcium and phosphate) in the plasma. These minerals and the concentration of parathyroid hormone play a paramount role in the bone metabolism throughout a lifetime.

Well-being of skin, gut, liver, kidney and bone is vital for Vitamin D metabolism. Activated Vitamin D works as a hormone, and its half-life (25(OH)D) is approximately 2—3 weeks.<sup>2</sup> This allows it to be a gene expression regulator, as part of immune function, cell proliferation and differentiation, and cell apoptosis.<sup>2</sup> The most commonly utilized biomarker for vitamin D sufficiency is 25(OH)D and this can be measured in the blood.<sup>3</sup>

The clinical questions asked here were:

- 1) How does Vitamin D impact the musculoskeletal (MSK) system in the developing pediatric patient and how does this translate into the growing child's need for nutritional intake or supplementation?
- 2) What are the specific factors that we clinicians need to

consider in order to help parents decide the appropriate supplementation for their child?  
 3) Is overdose a concern?

**Methods**

Literature search of large search engines, PubMed, Cochrane library, WHO. Key words used ‘Vitamin D and pediatric’, ‘Vitamin D and development’, ‘Vitamin D and deficiency’, ‘Vitamin D and side effects’.

*Inclusion criteria:* Articles in English language, Published within the last 10 years, Vitamin D supplementation consideration for healthy pediatric population 0-18 years old. Guidelines from global health agencies.

*Exclusion criteria:* supplementation for disease specific conditions, articles specific to premature infants. Articles commenting on Vitamin D interaction with other drugs and micronutrients. Excluded articles older than 10 years

**Results**

One Cochrane review, two global epidemiological reviews on nutritional rickets, six guidelines on Vitamin D supplementation, and several articles on vitamin D and musculoskeletal interaction were identified to answer the three questions reviewed.

1) *What is the Vitamin D impact on the musculoskeletal (MSK) system in the developing pediatric patient and how does this translate into the growing child’s need for nutritional intake or supplementation?*

The American Academy of Pediatrics and the Canadian Pediatric Society, the European guidelines recommended 400 IU/day for infant through adolescent age groups. Whereas IOM and WHO recommended adequate nutritional intake and if this is not met, to supplement children 0–1 and 1–18 years old with 400 and 600 IU/day, respectively.<sup>6</sup> See Table 1.

Homeostasis between vitamin D metabolism and parathyroid hormone ensure an efficient bone mineralization process in early infancy and childhood.<sup>5</sup> Fine balance between calcium and phosphorus concentration in the bloodstream is additionally vital. Randev et al., 2018, explained that correct mineralization in early life safeguards against early osteoporosis in adulthood.<sup>6</sup>

Shore, 2013<sup>7</sup> identified that infants younger than three months are somewhat protected from Vitamin D deficiency if sufficient placental transfer from the mother has occurred. However, other studies such as Bentley, 2013 expressed their concern as it indicated that maternal calcium

Name of organization	US IOM <sup>3</sup>	WHO	Canadian Pediatric Society <sup>30</sup>	The Endocrine Society Clinical Practice Guideline <sup>11</sup>	American Society of Pediatrics <sup>31</sup>	European Guidelines <sup>32</sup>	NHS Choices 2012 <sup>12</sup>
Neonates (IU/day)	400	200-400 5 to 10 mcg/ daily	Supplement breast feeding mother 4000IU/day or 400 infant directly	400	400	400	350-400 8.5-10mcg
Infants (IU/day)	400	200-400 5 to 10 mcg/ daily	800	400	400	400	10mcg
Children (IU/day)	600	Not specified	400-800	600	600	400	10mcg
Adolescent (IU/day)	600	Not specified	200-400	600	600	400	10mcg
NOTES			4000 IU/day vitamin D during pregnancy				

**Table 1. Summary of health agency’s Vitamin D daily recommendations.**

and vitamin D deposits are not sufficient for fully protecting the infant and supplementation is encouraged both during pregnancy and in early infancy.<sup>8</sup> In terms of dosage during pregnancy, 2800 IU/day, had a positive increase in bone mineralization of offspring at both one year and six years after the supplementation.<sup>9</sup>

This highlighted the importance of appropriate dosage and early vitamin D supplementation in pregnancy.<sup>10</sup>

Infancy and childhood is predominantly concerned with longitudinal growth and remodeling of the axial and appendicular skeleton.<sup>11</sup> On average children are expected to grow 5-6 cm and gain 2.5 kg per year until puberty, subject to gender variations. To meet these needs, the UK health department recommends 340-400 IU/day of Vitamin D. The Endocrine Society Clinical Practice Guideline<sup>11</sup> and the IOM support the need of supplementation with 400IU/day in this population.<sup>12</sup> Additionally they recommend at least 15 minutes of uncovered forearm and leg exposure to sunlight between May-September.

Holick et al., 2011, recommended that supplementation of 600–1000 IU/day should be considered if recommended daily sun exposures are not met. If the child is already deficient, they suggested a much higher dosage: 2000 IU/day of vitamin D for at least six weeks or 50,000 IU of vitamin D2 once a week for at least six weeks in an attempt to normalize the blood level of 25(OH)D above 30 ng/ml.

Additional adaptations of this dosage should be based on dietary vitamin D intake and overall bodyweight.<sup>13</sup> Lack of agreement is seen in the statement from the European Academy of Pediatrics (EAP) which still recommends 400 IU/day during the first year of life & 600 IU/day after the first year of life (1–18 years).<sup>14</sup> See Table 1.

The age group 9–18 years old, commonly is faced with rapid growth spurts and increased body mass, increasing the need for dietary calcium and phosphorus to maximize skeletal mineralization and maturation. During puberty, reduction in physical activity is commonly observed in females according to the *WHO Health Behavior in School-age Children* survey<sup>15</sup> and this gender gap increases with age. When exercise is decreased, there is less axial compression to aid bone mineralization. Similarly, if an inactive child enters a highly competitive sport, they might be more vulnerable for fracture if bone mineralization is out of balance.

2) *What are the specific factors that clinicians need to consider in order to help parents decide the best supplementation for their child?*

Common factors that play a significant role in appropriate supplementation of pediatric cases are: exclusive breast

feeding, fortified formula, fortified nutrition in diet, average daily exercise, and daily sun exposure based on their country's latitude, cultural dietary habits, anthropometric measurements and BMI. These factors should be evaluated in the history taking and then combined with any physical findings in the examinations.

Obesity in adolescence is a growing issue.<sup>16</sup> One-third of eleven-year-old children in developed countries, in 2014 were obese.<sup>17</sup> Nutritional choices in adolescence are questionable and it can be very difficult to accurately determine if sufficient vitamin D containing foods are consumed.

Obesity in adolescent children was found to have a faster exponential catalysis of 25(OH)D and parathyroid hormone compared to non-obese peers, especially females,<sup>18</sup> increasing the destruction of bone minerals. This signifies the importance of considering anthropometric measurement of children when supplementing vitamin D and adjust this value according to their BMI.<sup>18</sup>

One of the most commonly associated deficiencies of vitamin D in the pediatric population is nutritional rickets. Rickets was first described in the mid-17th century. Common signs and symptoms of nutritional rickets is insufficient mineralization of bone and cartilage, resulting in bowing of bones, stunted growth, and skeletal malformation.<sup>19</sup> Thus rickets is the result of disruption of appropriate endochondral ossification by not properly mineralizing the osteon.<sup>5</sup> Two global epidemiological reviews on nutritional rickets found that calcium deficiency is also a major component in nutritional rickets particularly in some African, Middle Eastern and Asian countries, despite their dietary lifestyle and sunshine exposure.<sup>20,21</sup>

Rickets typically develops in infants three to 18 months of age, if the problem is due to Vitamin D bioavailability.<sup>22</sup> Rickets due to lack of serum calcium can be seen up to the age of 16.<sup>23</sup> Rickets characteristically has two mechanisms: first, hypocalcaemia due to inappropriate gut absorption leading to reabsorption of calcium from bones (can also lead to seizures or tetany). Secondly, alteration of parathyroid hormone can result in hyperparathyroidism, hypercalcaemia, respiratory distress, muscular hypotonia, and skeletal demineralization commonly found in infants.<sup>20</sup>

The most effective diagnosis of rickets is done with the use of biochemical tests and x-rays (disordered mineralization and ossification of the physes of long bones).<sup>23,24</sup>

3) *Is overdose a concern?*

Supplementation of vitamin D is not completely without potential adverse effects. Some signs and symptoms are weakness, nausea, loss of appetite, headache, abdominal

cramps and diarrhea.<sup>25</sup> However, given that the pediatric population is likely to be deficient, the recommended dosage is very unlikely to cause toxicity.<sup>9,26</sup> Based on the literature, it is understood that although the risk of overdosing of Vitamin D is possible, this is extremely unlikely.

### Discussion

The purpose of this review was to improve understanding of the recommendations for Vitamin D supplementation for the growing child's musculoskeletal health, the required dosages, and the factors in individual patients that affect those dosages along with the risk of overdose in order to better serve my patients.

Although the recommendations vary slightly among organizations, consensus occurs in the recommendation of 400 IU/day in the infant and early childhood ages and 600IU/day in adolescent age population.<sup>6</sup> Although these recommendations are fairly straight-forward, the question that we are called to answer as MSK clinicians, is whether these supplementation values are appropriate for the population we treat. For example, most of the pediatric population in developed countries is not likely to have been exclusively breastfed for the recommended time (only 42% globally are breastfed to six months age or more).<sup>27</sup> Further, 144 million children globally have stunted growth and a further 38.3 million are overweight.<sup>27</sup> Add those to uncertain sun exposure and the risk for poor vitamin D status is high. Additional consideration and adaptation of recommended dosages is essential in obese patients, malabsorption syndromes, or on medications that interact with vitamin D absorption.

Therefore, it is important that we as clinicians take careful nutritional and physical activity histories of the pediatric patient particularly regarding exclusive breast feeding, fortified formula, nutrition and mean time of sunshine exposure, as well as if the family moved from a different location to current geographic latitude. Ideally, vitamin D deficiency is diagnosed based on a blood test via the GP. If access to blood tests is difficult or isn't the best first step, then the

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current 'over the counter' recommendation of 400 IU daily is indicated.

The WHO, in a position report in 2019, highlighted that not all health care practitioners are on board with supplementation despite exclusive breast feeding and skin pigmentation considerations.<sup>4</sup> The WHO is urging primary health clinicians to be familiar with daily recommended dosages, and to be vigilant in picking up early signs of vitamin D deficiency. Wagner et al in 2008 urged pediatricians and health care professionals to make vitamin D supplements readily available, considering the high likelihood of deficiency. Other authors support this point. Supplementation is now recommended to be initiated within the first few weeks of life and continue throughout childhood.

Fortunately, Vitamin D supplementation provides a cost effective and easy way to tackle nutritional rickets and once again reduce its prevalence in the pediatric population around the world which will help safeguard the next generation against adult conditions such as early osteoporosis.<sup>28</sup> Despite the fortification of food, the standards are variable across the globe. Thus a revision of early supplementation with higher dosage should be investigated. A very small number of articles have been currently available where investigation of 2000-5000IU/ day have been tested. This is a fast changing subject and thus results are subject to updates. We clinicians need to stay aware of this rapidly changing data as it becomes available for the betterment of our patients.

### Conclusion

At present, 400-600IU Vitamin D supplementation is the daily recommendation for the pediatric population based on the large healthcare agencies. However, as primary care clinicians, these values must be modified based on the history of each case. Anthropometric measurements, physical activity levels, dietary habits and sun exposure are key points that would significantly affect the correct recommendation and supplementation of Vitamin D. Correct advice can help reduce nutritional rickets in children and safeguard the developing musculoskeletal system.

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# Positive outcome from a chiropractic multidisciplinary approach for congenital torticollis in an infant three-weeks of age: A case report

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## ABSTRACT

**Background:** The purpose of this case report was to discuss the care of a pediatric patient with congenital torticollis who was treated by a chiropractor who initiated a multidisciplinary approach. **Methods:** Databases searched were PubMed, Cochrane, Index to Chiropractic Literature, CINAHL and google scholar. Keywords were torticollis, congenital torticollis, pseudotumor, plagiocephaly, spinal manipulation, chiropractic. **Case summary:** A mother brought her three-week-old infant to the chiropractor because she felt a nodule in the upper neck. After a thorough investigation of her history and an age appropriate physical exam, the diagnosis was congenital torticollis with a pseudo-tumor of the left sternocleidomastoid muscle (SCM). The intervention consisted of gentle spinal manipulation of the occipito-atlantal area, soft tissue therapy performed on the SCM, cranial manipulation along with home exercise instruction given to the parents. There was also a referral made to a physiotherapist for a consultation on the case with subsequent recommendations. The observed outcome was the resolution of congenital torticollis. **Conclusion:** This case report records the progress and positive outcome of a chiropractic multidisciplinary approach on pediatric congenital torticollis.

**Key Words:** Torticollis, congenital torticollis, pseudotumor, sternocleidomastoid muscle, plagiocephaly, spinal manipulation, chiropractic, pediatric, multidisciplinary.

## Introduction

Torticollis can develop due to a constrained intrauterine position in the last weeks of pregnancy,<sup>1,2,3,4,5,6,7,8,9,10</sup> breech lie,<sup>11,12</sup> birth trauma/forces during delivery<sup>3,4,5,7,8</sup> and late gestational age.<sup>7,8</sup> There are three types of congenital torticollis: postural, muscular and a sternocleidomastoid muscle (SCM) mass. The postural type presents as the infant's postural preference but without muscle or passive range of motion (ROM) restrictions.<sup>11</sup> The muscular type presents with SCM tightness and passive ROM limitations.<sup>11</sup> The most severe form, a SCM mass from congenital muscular torticollis (CMT) presents with a fibrotic thickening of the SCM and passive ROM limitations.<sup>13</sup> Other causes of torticollis can be a dysfunction in the cranio-cervical junction,<sup>14</sup> Klippel-Feil Syndrome (with or without Sprengel's Deformity),<sup>15</sup> a dysfunction in the upper cervical spine or can be caused by a "Kinematic Imbalance due to Sub-occipital Strain" (KISS).<sup>16</sup> The non-musculoskeletal reasons for infantile torticollis could be ocular, neurological or due to auditory problems.<sup>14,17</sup>

The pseudotumor of the SCM is related to severe presentations and consists of myoblasts, myofibroblasts, mesenchyme cells and fibroblasts in varied quantity and stage of differentiation or degeneration.<sup>18</sup> In newborns, the prevalence of this pseudotumor ranges from 0.3% to 2%.<sup>19,20</sup> There are a variety of treatments for the torticollis caused by a pseudotumor such as active positioning, traction, physical

therapy, medication, botulinum toxin injections, mobilization and exercises.<sup>19</sup> If conservative therapies are ineffective after a reasonable period of time (6–12 months), surgery should be considered.<sup>21</sup> There is also some evidence of consequences of torticollis that is not treated such as transient motor asymmetry, motor delay, and plagiocephaly, which would be reversible if addressed early and correctly.<sup>22,23</sup> Torticollis is a major risk factor for plagiocephaly. Chiropractic, which is part of complementary and alternative medicine (CAM) care has been found to be safe for children<sup>24,25,26,27,28</sup> and there is an evidence-based rationale for conservative myofascial and light adjustive techniques for the management of torticollis in both adults and children.<sup>29,30,31</sup>

## Case Presentation

*Patient information:* The mother presented her infant to the chiropractor because she felt a nodule in the neck of her infant at three-weeks-old. She had not noticed it previously and she was concerned. She also mentioned that her infant had a preferential head position, always rotated to the right side since birth. The baby was bottle fed and only from the right side (based on the baby's preference) The history of the pregnancy was unremarkable. She delivered at 41 weeks gestation. She chose to give birth in a hospital and she received Pitocin and an epidural to facilitate the birth. The second phase of the delivery was a long labor that lasted three hours. The baby presented with shoulder dystocia and the labor failed to progress. The fetal heart rate was

decelerating. They had to apply forceps three times to assist delivery. There was no caput succedaneum, plagiocephaly or nodule in the SCM noted at birth. The chiropractor was the first health professional she consulted for the nodule when she first detected it and no treatment was provided prior to the consultation in a chiropractic office.

*Physical exam:* During the physical exam, cervical range of motion was found restricted in left rotation and in right lateral flexion. During observation, her head was in right rotation and left lateral flexion. The cranial shape, distorted due to the muscular traction, caused the head to “bulge” at the left occiput (which contrasted with the flatter right occiput) and there was a nodule palpated at the distal part of the SCM near the clavicle. Upon palpation of the cervical spine, there was a restriction palpated at C1 on the right. The eyes were symmetrical but not level and the ears were asymmetric in position with the left ear more anterior than the right ear with a facial distortion. There was no sign of fracture. The scapulae were not fixed ruling out Klippel-Feil Syndrome with Sprengel’s Deformity. The neurologic exam (including infant reflexes) was normal and appropriate for gestational age with negative Ortolani and Barlow’s tests.

*Diagnostic assessment:* Imaging or laboratory tests were not considered clinically necessary at the initial stage of treatment. Differential diagnoses included spinal tumor, Klippel-Feil Syndrome with Sprengel’s Deformity or hemivertebra. It was determined a priori that if the patient did not respond to conservative measures in a reasonable period of time utilizing techniques modified for the child’s age and size, or if there were any adverse reactions, diagnostic imaging could be ordered. Because there was a palpable nodule, the limited motion was unilateral for rotation on the contralateral side of lateral flexion. There was no lowered hairline. The working diagnosis was a pseudo-tumor (nodule) of the left SCM. The prognosis for a pseudo-tumor is unknown because the type three nodule in congenital torticollis is the most complex type of congenital torticollis. Because the pseudo-tumor is a mix of myoblasts, myofibroblasts, mesenchyme cells, and fibroblasts in varied quantity and stage of differentiation or degeneration, it can take longer to release the nodule in the SCM. Often, it leads to positional plagiocephaly because of the traction of the shortened muscle on the plates of the cranium restricting the head from full range of motion. The goal is full, normal cervical ROM without side preference. A second opinion was recommended by the chiropractor in an attempt to corroborate the diagnosis and to rule out other causes and to seek co-management with a physiotherapist with an appropriate exercise protocol.

*Treatment:* The intervention began for the infant at three weeks old. The treatment consisted of spinal manipulation of C1 with diversified technique modified for the patient’s

age and size, muscular treatment of the SCM with a fingertip pressure applied for 30 seconds and cranial mobilization of the occiput and parietals bilaterally. Recommendations for the parent at home were to passively rotate the head to the left and laterally flex to the right. The parents were also instructed to perform some massage on the SCM eight times a day as well as consistently positioning the infant prone, in tummy time (Table 1)<sup>14,32,33</sup> and to stimulate her on the left side by placing themselves or brightly colored objects on that side. The planned frequency of the chiropractic treatment was twice a week for six treatments followed by a re-evaluation to assess progress. After four treatments, the chiropractor added sacro-occipital distraction and lateral flexion traction to facilitate increased range of motion and release tension in the musculature. There was also a recommendation for co-management with a physiotherapist for support with the exercises. She went to physiotherapist once a month to support the exercises that the mother was doing everyday at home. The physiotherapist gave her additional exercise to do at home.

Age	Minutes per day
1 week	5
4 weeks	10
8 weeks	20
12 weeks	45
16 weeks	80

**Table 1. Recommended tummy time per day. Miller J, Vallone S. What is Tummy Time: is it necessary for newborns?<sup>39</sup>**

*Follow-up and outcomes:* After five treatments, the originally restricted ranges of motion were within 90% of full range and she was able to hold her head in a neutral posture for a sustained period of time. After seven treatments, it was noted that the nodule in the SCM began to release. After 13 treatments, the infant started to move her left arm freely and to use it to grab things. After 18 treatments, the nodule was no longer there. Within three months, at twice a week for three weeks and then once a week, the SCM was released and the ROM was within normal limits. Because of the prolonged posturing of the head in right rotation and left lateral flexion, the head shape had become plagiocephalic with flattening of the right occiput. At the 14th treatment, the plagiocephaly was considered mild with a score of 77 on the cranial vault asymmetry index (CVAI).<sup>34</sup> At five months old, she was re-evaluated by her medical doctor for her plagiocephaly. In the Argenta classification scale, the patient was type 2.<sup>35</sup> The medical doctor offered an orthotic helmet because of aesthetics. The timeline is outlined in Figure 1 (next page). The mother made a comment on her feedback form that she was satisfied with the outcome (Table 2 next page).

1st visit 14/09/2017	Head is rotated to the right side and is in left lateral flexed	
5th visit 03/10/2017	Head is more midline. There is less tension in the SCM and the SCM is lengthened; pseudotumor remains palpable. ROM of cervical spine is 40° in left rotation and 35° in right lateral flexion	
18th visit 19/12/2017	The ROM in the cervical spine is unrestricted and there is no palpable nodule anymore but there's a mild plagiocephaly.	
22th visit 08/02/2018	At 5 months, she had an orthotic helmet with the intent to reduce her mild plagiocephaly.	

Figure 1. Timeline.

“At each treatment, in respect to my daughter’s head posture and her reaction during the treatment, the chiropractic manipulation helped her. We saw great results during the evolution of the treatment. The chiropractor modified the treatment so that my daughter could tolerate it, and it helped to achieve more each treatment. It helped with the pseudo-tumor resulting in less muscular tension and more range of motion.”

Table 2. Maternal feedback after treatment

**Discussion**

This patient presented with restriction in right rotation and left lateral flexion of the neck with a nodule in the left SCM. The true etiology of the congenital torticollis still remains uncertain, but this baby’s assisted birth with repeated forceps applications was most likely implicated. The routine treatments for her type of torticollis are active positioning, traction, physical therapy, medication, botulinum toxin injections, mobilization and exercises.<sup>21</sup> In this case, the parent approved a multidisciplinary approach with chiropractic mobilization, physical therapy, and exercises. In the literature, there is evidence that earlier intervention results in the best outcomes.<sup>36</sup> In this case, the parent presented the child as soon as the pseudotumor was noticed (when the infant

was three weeks old). Ohman et al provided preliminary evidence of better outcomes when infants are treated by PT versus parents, but the combination of physical therapy and home program is the more frequent intervention plan.<sup>37</sup> Kaplan et al stated that there is evidence that intervention started earlier will take less time to resolve ROM limitation; there are greater reductions in SCM thickness and there is less need for subsequent surgical intervention.<sup>36</sup> Petronic et al found that when treatment was initiated before one month of age, 99% of infants with CMT achieved excellent clinical outcomes with an average treatment duration of 1.5 months, but if initiated between one and three months of age, only 89% of infants achieved excellent outcomes with treatment duration averaging 5.9 months.<sup>38</sup> Kaplan et al state that the presence of a fibrous band and/or mass, particularly a mass that involves more than the distal one-third of the muscle, is correlated with greater severity of the condition.<sup>36</sup> Regarding the prognosis, Kaplan et al identified seven factors associated with a longer episode of care including: (1) older age at initiation of treatment, (2) increased restriction of passive neck rotation, (3) increased severity of head tilt, (4) motor asymmetry, (5) increased thickness or stiffness of the involved SCM or higher thickness ratio between the involved and uninvolved SCM, (6) the presence of an SCM mass or lesion, and (7) delivery history including infants with lower birth weight and breech, compared with cephalic presentation.<sup>36</sup> For the multidisciplinary approach, Kaplan et al say that throughout the episode of care, the PT should collaborate with the infant’s physician and the family to make a judgment about when to increase the intensity of direct physical therapy treatment or consider alternative approaches.

In this case, it took three months to gain complete ROM with no SCM thickness. Because the first treatment was almost at the end of the baby’s first month and the congenital muscular torticollis was severe with the SCM mass, it can be a reason why it took longer than 1.5 months. However, the case was complex and the multidisciplinary approach was utilized as recommended by Kaplan et al.<sup>36</sup> The resolution of the congenital muscular torticollis with a SCM mass was complete. The resolution of the plagiocephaly was not 100% and the use of a helmet was instituted for aesthetics.

**Limitations**

There were several limitations of this study. The first limitation is the small sample size. It is only one case with this diagnosis, subjective evaluation and follow up. The other limitation is the case management which was multidisciplinary including the treatment by the physiotherapist (and the additional exercises). There were potentially many factors that could have influenced the result such as the parents’ compliance with the recommendations for home care. We were not able to determine whether the treatment “beat” the natural course and history of this disorder.

The strength of the case is the amelioration of the symptoms with objective measures, with a chiropractor leading the care. Physiotherapy and parental implementation of exercises were also part of the treatment plan. The consequence of plagiocephaly from her congenital torticollis occurred in this case and the child went to medical care for orthotic therapy for the mis-shapen cranium at the close of the original treatment plan.

## Conclusion

This case report suggests that chiropractic care, combined with physiotherapy and in-home exercises can provide help for the treatment of a nodule in the SCM in a new-born infant. These treatments merit further investigation.

Informed consent has been obtained to share this case report including photographs.

## Funding Sources and Conflicts of Interest

No funding sources or conflicts of interest were reported for this study

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# The impact of feeding modalities on infants' orofacial development: Breastfeeding versus bottle-feeding in infancy, a scoping review

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## ABSTRACT

**Introduction:** Exclusive breastfeeding is recommended for at least six months in infants and encouraged up to two years of age. However, only 35% of infants are breastfed up to six months in the US. This rate drops down to 16% for breastfeeding at 12 months. Some authors suggest that breastfeeding also plays an important role in optimal musculoskeletal development of the orofacial system in the infant. On the contrary, bottle feeding could negatively affect these musculoskeletal structures resulting in abnormal development of the stomatognathic system. This review aims to answer the question: "What are the musculoskeletal effects of bottle feeding versus breastfeeding in infants' orofacial development and function?" **Methods:** Online databases (PubMed, ResearchGate, Cochrane; ICL, EBSCO, SCielo) have been searched to identify relevant articles. No limit was set for date, study design and level. **Results:** The search resulted in identifying four systematic reviews and two case control studies. Four literature reviews highlighted great heterogeneity in methodology and findings. Authors agreed that exclusive breastfeeding and breastfeeding duration were associated with optimal development of palate, dentition and myofunctional habits. Bottle feeding, on the other hand, influenced the activity and function of masseter, tongue and temporalis muscles, leading to a V shaped palate and long-term malocclusions. **Conclusion:** There were few large-sample high-quality studies focusing specifically on infants' orofacial development; further research is needed to deepen the knowledge of factors relating to musculoskeletal development during infancy.

**Key Words:** Breastfeeding, bottle feeding, orofacial complex, stomatognathic development, infants.

## Introduction

Exclusive breastfeeding provides multiple benefits, both short and long term, for mother and child.<sup>1</sup> These include immunological, nutritional, cognitive and psychological benefits.<sup>2,3,4,5</sup> Major health organizations such as the World Health Organization, recommend exclusive breastfeeding for at least the first six months of life and up to two years of age.<sup>6</sup> However, breastfeeding is not always initiated and sustained as the exclusive feeding method for infants, so that only 35% of infants appear to be exclusively breastfed at six months in the US and only 16% are still breastfeeding at 12 months of age.<sup>7</sup> Alternative feeding methods, such as bottle feeding, are used in combination with or instead of feeding at the breast.

The greatest craniofacial growth happens in the first four years of life, with facial structures, maxilla and mandible especially, developing more slowly than the cranial vault and cranial base.<sup>8,9</sup> Orofacial bone maturity is reached at 16 years of age. The shape and size of the maxilla and mandible are therefore subject to remodeling until that age. As the size of the skull base and vault are influenced by brain growth, the masticatory muscles and the myofunctional habits of the infant influence orofacial development. Since breastfeeding is one of the primary and most complex activities engaging the infant, this raises the question of

whether infant feeding modalities could influence the malleable orofacial anatomy.<sup>9</sup>

This hypothesis is reflected by the medical literature as researchers suggest that breastfeeding influences the stomatognathic and maxillofacial development and function.<sup>10</sup> On the other hand, bottle feeding may engage these oral-motor structures differently and potentially cause changes in the function of those same structures.<sup>11</sup>

This hypothesis should be of interest to healthcare professionals caring for the pediatric patient, particularly from birth to four years of age.

By understanding the risks and benefits of breastfeeding versus bottle feeding, clinicians can effectively communicate to nursing mothers and help them to make an informed decision about feeding modalities. Furthermore, many chiropractors care and work with neonates with breastfeeding issues. This review supports the need for and importance of early resolution of breastfeeding difficulties. Finally, by identifying the oral-motor dysfunctions that contribute to poor orofacial development, the chiropractor can focus on investigating potential "corrective" techniques in order to restore competency and promote the correct musculoskeletal (MSK) function and development.

In order to give a comprehensive view of the musculoskeletal effects of feeding modalities, two aspects were highlighted in this report: the effect of breastfeeding versus bottle feeding on the muscle activation in healthy infants (without congenital conditions such as cleft palate or ankyloglossia) and the effects of prolonged and exclusive breastfeeding versus bottle-feeding on orofacial anatomy.

This literature review addressed the question: "What are the musculoskeletal effects of bottle feeding versus breastfeeding in infants' orofacial development and function?"

### Methods

This is a scoping review addressing the question: "What are the musculoskeletal effects of bottle feeding versus breastfeeding in infants' orofacial development and function?"

### Literature search

A primary literature search was carried out on PubMed, Cochrane database and ICL for peer reviewed literature. This primary search also aimed to identify correct terminology and background literature. Search terms included both free text terms and MeSH terms, used alone and in combination: "infants/infant"; "breastfeeding" AND/OR "bottle feeding" OR "feeding" "effect" OR "risk factors"; "orofacial" OR "stomatognathic"; "malocclusion."

A second search was carried out with EBSCOhost and ResearchGate to identify free full text articles, which were then critically appraised following the CASP checklist (Critical Appraisal Skills Program (CASP)).<sup>12</sup>

Search terms included both free text terms and MeSH terms, used alone and in combination: "infants/infant"; "breastfeeding" AND/OR "bottle feeding" OR "feeding" "effect" OR "risk factors"; "orofacial" OR "stomatognathic"; "malocclusion."

A hand search was then carried out in order to identify relevant articles among the references of the selected studies.

### Selecting sources of information

One author searched, critically appraised and selected articles for this paper; the author was not blinded to the research question.

Inclusion criteria consisted of English language research articles investigating breastfeeding and bottle feeding effects on the development of orofacial structures in terms of size and shape; articles providing data on feeding modalities, on consistency of breastfeeding and bottle feeding (duration, frequency and differentiation among different levels of breastfeeding and bottle feeding: exclusive, almost exclusive and partial) in infants and their influence on musculoskeletal structures. Studies investigating the effects of

feeding practices on older subjects (children and toddlers > 12 months old) were consulted if providing retrospective data on the same subjects at <12 months old but not included in the results summary. Studies were excluded if not relevant; focusing on infants with congenital malformation or conditions linked to abnormal orofacial development; or if methodology was insufficiently described or absent. Other studies, such as commentaries and experts' reviews were consulted for background literature. Relevance was determined through title, abstract and full text. In order to decrease selection bias and avoiding exclusion of relevant articles no limit was set for level of evidence, study design, or date.

### Results evaluation

There were 33 records selected for full-text evaluation and 27 were discarded due to lack of relevance. The articles included were appraised according to the CASP checklist. Studies were evaluated and presented according to their design. Two tables were produced: one for the observational studies, one for literature reviews. The tables identified authors; study design, year of publication, methodology, outcome. A "comment" section was included in the summary tables to define CASP grading and potential limitations of each study. CASP checklist is not a grading system. In this case it was used in order to highlight those areas of the studies which could lack of information or clear methodology. These areas were then discussed in the discussion paragraph of this paper.

Studies evaluated with CASP checklist:

- Inoue et al.,1996 Control study. CASP: 10/11 item 7 "can't tell"
- Gomes et al.,2006 Cross-sectional study. CASP 10/11 item 7 "can't tell"
- Abreu et al.,2016 Systematic review. CASP: 9/10 item 8 "no"
- Hermont et al., 2015 Systematic review. CASP 10/10
- Peres et al., 2015 Systematic review. CASP 10/10
- Thomas et al., 2018 Systematic review. CASP 10/10

### Results

Six studies were included in the results summary; four systematic reviews and two case control studies were appraised with the CASP checklist.<sup>12</sup> See figure 1 (next page) for PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) chart.

Four systematic reviews endorsed a protective effect of breastfeeding against malocclusions (MOs) such as cross bite, posterior cross bite, over-jet and crowding.<sup>13,14,15,16</sup> These studies reported data from prospective and retrospective cohort studies about breastfeeding duration in infancy versus bottle feeding. The retrospective data, such as type of feeding received and duration, were primarily col-

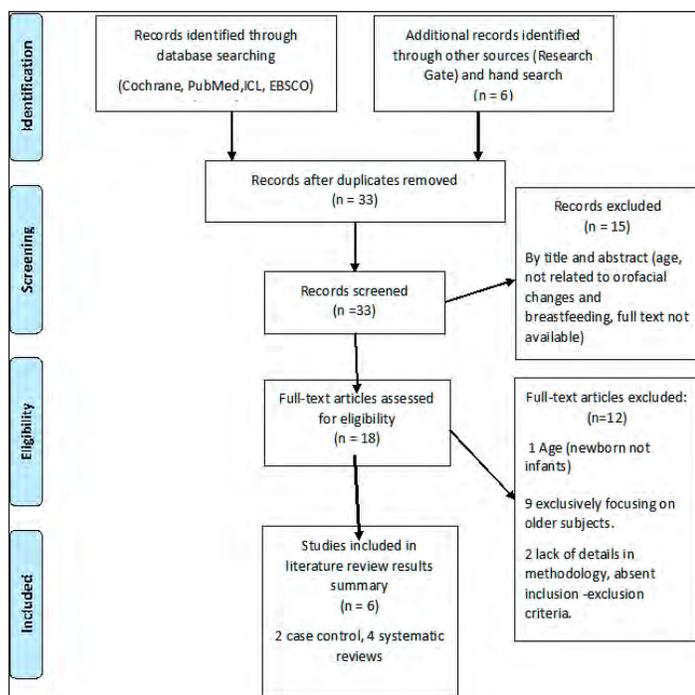


Figure 1. PRISMA 2009 Flow Diagram<sup>32</sup>

lected via questionnaires. The presence of musculoskeletal changes in the orofacial structures of children was assessed at different ages (3 to 12 years). These studies suggested that breastfeeding and duration of breastfeeding was inversely proportional to the development of MOs in childhood. All four of the reviews highlighted how the evidence available is heterogeneous in both findings and methodology.

Two case control studies focused on myofunctional changes on infants exclusively, during breastfeeding and bottle feeding.<sup>17,18</sup>

These studies reported significantly lower activation of masseter and temporalis muscles in bottle fed infants than breastfed infants.

In one double-blind cross-sectional study of 60 infants' (age 30 to 90 days) participants were divided into three groups, with a convenience sample of 20 subjects in each group. Group 1 (G1) who were exclusively breastfed by parents; group 2 (G2) was breastfed and bottle fed and group 3 (G3) was breastfed but could receive cup feeding during electromyography. The median age for each group was 83.50 days for G1, 82 days for G2 and 84 days for G3. Masseter, temporalis and buccinator were measured with EMG one time during the study. The statistical analysis showed that mean contraction of the masseter in the breastfeeding group (median of 80  $\mu$ v) differed significantly from that of the bottle feeding group (median of 50  $\mu$ v). Temporalis muscle activation differed between breastfeeding and bottle feeding groups too, showing higher mean activation of temporalis

in the breastfeeding group (median of 111.25  $\mu$ v) and cup feeding (median of 96.04  $\mu$ v) groups VS lower activation in the bottle feeding group (median of 48.03  $\mu$ v).<sup>18</sup>

Breastfeeding and cup feeding showed similar and higher activity of masseter and temporalis muscles (mean contraction measurements and range of contraction measurements) on EMG compared to bottle feeding. On the other hand, bottle fed infants showed higher activation of buccinator muscle, however this difference was only observed when measuring range of contraction and was not statistically significant.<sup>18</sup>

In another study, 36 infants (two to six - months of age) were divided into three groups. It included one experimental group who had never experienced breastfeeding or abandoned it within two months after birth and used a chewing type bottle mimicking breast shape and two control groups. These control groups included 12 exclusively breastfed infants and 12 infants who were already accustomed to bottle feeding only before the research started. Mean age for each control group at time of measurement was not reported. The EMG measurements showed higher masseter activation in the breastfed (56.3  $\mu$ v) and chewing-type bottle groups (55.7  $\mu$ v). In the bottle fed group, the masseter showed lower activation (27.9  $\mu$ v) and its activity occasionally disappeared during feeding.<sup>17</sup> The research concluded that higher masseter activation is present in breastfed and chewing-type artificial teat fed infants and this muscle activity was significantly lower in bottle feeding.

Additionally, one narrative review and two commentaries on craniofacial development in association with feeding modalities in infants were included.<sup>8,10,19</sup>

Palmer described how, in breastfeeding, oral vacuum pressure required for milk extraction is given by higher energetic jaw compression and peristaltic motion of the tongue.<sup>8</sup> During bottle feeding, the tongue exerts a strong piston-like movement and protrusion to stop milk overflow. This powerful suction activates the oral musculature in a non-physiological way and results in the cheeks being drawn in and pressed against the gums during feeding. This forceful suction is not required in breastfeeding as the entire oral and perioral musculature (including tongue, masseter, temporalis and pterygoids) assist suckling in a coordinated and physiological manner.<sup>8,18,19</sup>

Tables 1 and 2 (next page) provide a result summary of muscular impact of type of infant feeding.

## Discussion

### Studies evaluation

The purpose of this scoping review was to investigate the

AUTHOR	METHOD	OUTCOME	COMMENT
<b>Inoue et al, 1996</b>	Case control, EMG study of masseter activation in three groups of infants aged 2-6 months: GA)12 subjects offered bottle teats chewing type; GB)12 s breastfed exclusively; GC)12 bottle fed with sucking type bottle.	Significant P. 0.01 lower activation of masseter muscles in sucking type bottle feed subjects compared to breastfed and chewing type bottle fed subjects. In bottle feed subjects masseter activation occasionally disappeared during feeding.	CASP 10/11 — all but item 7: “can’t tell” Very small subject group.
<b>Gomes et al, 2006</b>	Cross sectional study, surface EMG study of on 60 full term healthy infants aged two to three months. GA) breastfeeding only GB) breastfeeding plus bottle feeding GC) breastfeeding plus cup feeding.	Masseter and temporalis activation was smaller in bottle feeding group than BF and Cup feeding and BF groups (p. 0.05). Buccinator activation was slightly higher in bottle-fed group, but not statistically significant (P > 0.05).	CASP 10/11 Item 7 “can’t tell” Very small subject group.

**Table 1. Case-Control EMG studies. BF: Breastfeeding; G: Group; MOs: Malocclusion; MSK: Musculoskeletal.**

AUTHOR	METHOD	OUTCOME	COMMENT
<b>Abreu et al, 2016</b>	Systematic review of epidemiological studies addressing BF, bottle feeding and mixed feeding (bottle and BF) and risk of MOs in mixed or/and permanent dentitions.	Six studies evaluated reveal heterogeneity of results. Evidence based on low-quality cross-sectional studies. The findings do not support an association between BF and bottle feeding and the occurrence of MOs in mixed and permanent dentitions.	CASP – 9/10 all but item 8 “no.” Limitations due to articles selected: heterogeneity of methodology, meta-analysis not possible, insufficient data. Does not report MSK changes at infant age.
<b>Hermont et al, 2015</b>	Systematic review of observational studies addressing BF and BF duration in association with MOs compared to bottle feeding.	Ten cohort studies evaluated revealing protective effect of BF against MOs and directly proportional to duration of BF. Bottle feeding associated with posterior cross bite and overjet in a study. However, evidence and data are not sufficient.	CASP – 10/10 Limitations intrinsic to studies available: heterogeneity in methodology and findings. Does not report MSK changes at infant age.
<b>Peres et al, 2015</b>	Systematic review and meta analysis investigating protective effect of BF and BF duration on MOs in children.	Forty-one articles evaluated in the meta analysis revealing protective effect of BF against MOs.	CASP – 10/10 Limitations intrinsic to heterogeneity of single studies. Does not report MSK changes at infant age.
<b>Thomas et al, 2018</b>	Systematic review and met analysis of observational studies addressing BF and BF duration in association with MOs compared to bottle feeding.	Forty-two studies evaluated revealing protective effect of BF against MOs and directly proportional to duration of BF. BF children have adequate growth of maxillary and mandibular bone bases in frontal, transverse and sagittal planes. MOs associated with BF<6 months or bottle feeding.	CASP – 10/10 Potential recall bias, high statistical heterogeneity. Non-nutritive sucking habits could be interpreted as confounders or mediators. Does not report MSK changes at infant age.

**Table 2. Systematic Reviews. BF: Breastfeeding; G: Group; MOs: Malocclusion; MSK: Musculoskeletal.**

association between infant bottle and breastfeeding with the development of malocclusions (MOs) in childhood and adolescence.

All in all, there is a paucity of studies investigating abnormal orofacial development in infants (1 to 12 months). Most of the literature focused on the role of exclusive breastfeeding and bottle feeding on long term MSK changes. These changes were observable in an older age group (three to twelve years) and included different types of MOs : anterior and posterior cross bite, crowding, overjet and other forms of abnormal orofacial development, such as changes in tongue resting position and maxillary arch shape.<sup>20,21,22</sup>

#### *Different activation of masseter and temporalis during breastfeeding*

It goes without saying that the musculoskeletal structures in the infant are very malleable in the early stage, therefore repeated muscular action, changing the internal and external pressures applied, can affect the anatomy of the stomatognathic system.<sup>19</sup> The two electromyography (EMG) studies determined that masseter and temporalis activation was lower in bottle fed infants. It is important that we critically assess these studies because they were carried out on relatively small samples and consisted of a single measurement in time.<sup>17,18</sup> That said, these findings do corroborate other authors' description of breastfeeding mechanism compared to bottle feeding, with higher masseter and temporalis activation leading to energetic jaw compression.<sup>8,19</sup> On the other hand, a higher range of buccinator muscle activity was observed during bottle feeding, although this finding was not significant. The buccinator is not always considered a key breastfeeding muscle. This finding does correlate with statements by other authors who reported this higher activation with bottle feeding.<sup>18</sup>

This forceful suction would result in drawing inwards and thickening the cheeks, applying pressure to the malleable gums, thus compromising dentition.<sup>23</sup>

Tongue action during bottle feeding may promote malocclusions

Certain authors suggested that while in the breastfeeding infant the tongue executes a peristaltic motion with involvement of the intrinsic muscles of the tongue, in bottle feeding this is substituted with a forceful protrusion, mainly aimed to control milk overflow.<sup>8,20</sup>

We could speculate that in bottle feeding the genioglossus is highly activated and responsible for this protrusion. Although peristalsis of the tongue has been recorded in infants feeding from an artificial nipple, thus showing that intrinsic muscles are activated during bottle feeding too, there are no studies comparing the specific tongue's dynamics in

bottle and breastfed infants.<sup>24</sup> Hypotonicity of the tongue in bottle fed infants would explain why bottle fed infants tend to rest the tongue on the mandibular arch. In the breastfed infant, the tongue rests on the maxillary arch.<sup>20,21</sup>

Tongue resting on mandibular arch is associated with maxillary arch atresia, a dentofacial deformity consisting of a narrowing of the upper arch and a deep gothic palate.

A "V" shaped palate is in fact seen in many MOs cases, especially posterior cross bite.<sup>21</sup> On the contrary, natural breastfeeding has been shown to directly enhance the development of the "U" shaped palate in two ways. First, by requiring optimal activation of the tongue by peristaltic motion,<sup>19</sup> and second, by exerting repeated pressure on the malleable infant's palate with the mother's breast, whose anatomy matches the infants' oral cavity.<sup>8</sup>

#### *Long-term impact of feeding modalities*

The literature points out how feeding modalities can affect children's orofacial development in the long term and that many MSK changes occur, they are gradual and develop over time.<sup>25,31</sup> The greatest changes and growth in orofacial structures, especially maxilla and mandibula, take place in the first four years of life. This leaves a broad time frame during which compensations leading to MSK changes can develop and perpetuate. This would possibly explain why MOs and myofunctional changes are observed after infancy and children > 5 years old.<sup>26,27</sup>

Other factors could influence the child's orofacial development after infancy in that time frame as well. Carrascoza reported that the suboptimal tongue resting position seen in bottle fed infants predisposes to suboptimal position of the incisors as well as posterior cross bite in children > 12 months. Their study on 202 children (age four years old) who were exclusively breastfed for the first six months of life and then switched to other type of feeding were divided into 101 bottle users and 101 cup users for drinking. The study reported how the subsequent bottle feeding was associated with suboptimal tongue resting position ( $p < 0.0001$ ), mouth breathing ( $p < 0.0001$ ) and maxillary arch atresia ( $p = 0.0206$ ). These findings highlighted how, regardless of early breastfeeding, the use of bottle versus cup feeding can predispose to MSK changes even after infancy.

Furthermore, the same authors reported how hypertrophy of buccinator muscle, required for forceful suction in bottle feeding, would compromise optimal mandibular growth and function.<sup>20,27</sup>

#### *Other oral habits, such as pacifier use, can influence orofacial development*

Studies highlighted that, when evaluating risk factors for suboptimal orofacial MSK development, feeding modalities

ties such as breastfeeding and bottle feeding in the first year of life be the only factors considered. In fact, regardless of the protective role of exclusive breastfeeding in first six months of life, other oral habits can develop and influence this positive outcome.<sup>20</sup> The aetiologies of suboptimal MSK development have to be considered in their multifactorial and complex dynamics.

Peres demonstrated that children who used a pacifier regularly between 12 months and four years of age developed an anterior open bite 3.6 times greater than those who did not, while children with the habit of digital sucking at six years of age had a 1.4 times greater incidence than those who did not.<sup>28</sup> The same author stated that bottle feeding fails to promote optimal jaw movement and the natural swallowing mechanism, confirming the findings by Carrascoza.<sup>20,28</sup>

#### *Breastfeeding as a protective factor against MOs*

It is important to point out that two studies revealed how breastfeeding is protective against MOs.<sup>29,30</sup> Breastfeeding promotes optimal mandibular function and decreases the risk of anterior open bite, posterior cross bite and overjet.<sup>29,30</sup> Furthermore, it protects against the development of both non-nutritive sucking habits and it promotes nasal breathing.<sup>29,30</sup> This is in contrast to bottle feeding which promotes mouth breathing. Mouth breathing is associated with development of maxillary arch atresia and MOs.<sup>20,21</sup>

According to a literature review, children who breastfed over six months had lower chance of overjet, anterior and posterior cross bite.<sup>19</sup> This was an oral health study nested in a birth cohort study conducted on 1303 five year old participants.<sup>25</sup> The prevalence of anterior open bite was 43.0% lower in children who were exclusively breastfed up to six months of age compared with those who were not breastfed. Furthermore, duration of exclusive breastfeeding was found inversely proportional to the prevalence of MOs (72.0% lower in children who were breastfed up to 6 months, 43.0% lower in children breastfed between 3 and 5.9 months).<sup>25</sup>

The literature therefore highlighted how breastfeeding can have an important protective role against abnormal orofacial growth and development. The problem is that its beneficial effects could be buffered and minimized by other influencing factors taking place during or after cessation

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of lactation, including bottle feeding, thumb sucking, pacifier use and different causes of mouth breathing (from the non-pathological predisposition caused by bottle feeding to other pediatric conditions, such as adenoid hypertrophy and upper airway obstruction).<sup>20,21,29,30,33</sup> The literature also stressed how duration and consistency of feeding modality impact the orofacial development.<sup>25,27</sup>

Orofacial bone maturity is not reached until 16 years of age, with the first four years of life being the time of greatest orofacial growth and change. There is then a great span of time when minor and major MSK changes may occur. It is important to remember how a great heterogeneity of factors interact with each other over time, and how these factors could influence change at different times in the child's development.

#### Limitations

Limitations of this scoping review include the lack of systematic literature reviews on this topic related to infants specifically, the diversity of methods and findings present in the literature, the intrinsic limitation of certain study designs, which acquired data retrospectively and through questionnaires (this leading potentially to recall bias) and the paucity of literature on infants specifically. In fact, certain confounders, such as non-nutritive oral habits (pacifier, thumb sucking) could have influenced the results. Finally, literature search as well as appraisal of papers was carried out by a single, non-blinded author, thus increasing the risk of collection and inclusion bias.

#### Conclusion

Exclusive breastfeeding and longer duration of breastfeeding have been reported to be a positive influence on the development of orofacial structures during the first four years of life. Bottle feeding is instead associated with the development of malocclusions in childhood and disruptive myofunctional habits in infants. It is still the case that more research is required to reduce confounding factors since the child's craniofacial growth results from complex interaction between feeding techniques, their consistency, duration, presence or absence of non-nutritive sucking habits.

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# The transition from gavage feeding in premature infants: What is the effect of non-nutritive suck on improving oral and breast feeding and hospital discharge in this population? A literature review

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## ABSTRACT

**Background:** Premature infants born prior to 34 weeks gestation have difficulty with immature suck-swallow-breath reflex, and thus gavage feeding is the most common method of delivering adequate nutrition. **Objective/aims:** The aim of this study was to investigate the current research and determine if non-nutritive suck (NNS) as part of sensory motor oral-facial stimulation (SMOS) is an appropriate early intervention and to identify whether this intervention facilitates transition to oral feeding in premature babies. **Methods:** A literature search was undertaken from 2000 to May 2020 to identify articles that assess this area. A variety of terms were used including MeSH Terms “enteric nutrition” “gavage tube feeding”, “breastfeeding”, “premature infants” “oral-motor stimulation”, ‘non-nutritional sucking’. **Inclusion criteria:** Articles in English language; population of preterm infants less than 34 weeks; articles that looked at non-nutritive suck and its effects. **Exclusion criteria:** any other feeding devices than gavage feeding/naso-gastric tube used, premature infant with congenital anomalies, or ventilation support, older than 34 weeks gestation. **Results:** Eleven studies in total were identified as relevant: 3 systematic reviews, 5 RCTs, 2 cohort studies, 1 observational cross sectional study. Pacifiers (non-nutritive suck) along with sensory motor oral stimulation were found to improve coordination of suck-swallow-respiration and breastfeeding and earlier release from hospital in multiple cases. However, the research is heterogenous and overall, inconclusive. **Conclusion:** The research demonstrated mixed outcomes for the effectiveness of pacifiers and the use of NNS. No clear guidelines exist to facilitate smooth transition to oral feeding in the NICU. Given the lack of negative outcome with the use of NNS as well as understanding the effect of NNS on the activation of vagal tone and the benefits this has on the gut motility and overall health of preterm infants, it appears to be a viable tool to help reduce hospital stay and facilitate infants toward oral feeding.

## Introduction

The suck-swallow-breathe reflex (SSB) appears at approximately 28 weeks gestation.<sup>1</sup> Nevertheless, some premature infants born prior to 34 weeks gestation commonly have difficulty with oral feeding as the suck-swallow-breathe reflex is immature or even absent. In addition, this group lacks the appropriate oral-facial coordination and thus tube feeding is currently the most reliable method of feeding at this stage of their lives.<sup>2</sup>

Gavage feeding ensures that the infant receives the appropriate nutrition to achieve weight gain and growth with a view to proceed to independent oral feeding. However, this method of feeding comes with a set of drawbacks such as: increased mouth sensitivity, gag reflex hypersensitivity, prolonged Naso-gastric (NG) tube use, excessive time supine and reduced varied mobility, all of which can lead to a difficult transition to breastfeeding.<sup>3</sup> Additional hospitalization time and budget is also spent on post discharge as this can have an effect on feeding and speech at a later stage.<sup>4</sup> Financially, this is a huge burden on the NICU and an added strain in the bonding experience between mother-infant dyad.

The positive effects that breastfeeding has on both mother and infant have been well documented in the literature and thus the swift transition to breast feeding is paramount in premature infants.<sup>5</sup> The aim of this review was to investigate the available evidence and determine if non-nutritive suck (NNS) is an appropriate early intervention to aid successful transition to oral feeding and in best cases, breastfeeding, in premature babies.<sup>5</sup>

## Background

Premature infants will not be discharged from the NICU until they can demonstrate effectively stable vital signs and the ability to safely feed orally.<sup>3,6</sup> This is a sign of neurological maturity of the medullar region and autonomic function especially appropriate use of vagal tone.<sup>7,8</sup> Heart rate variability and gut motility are two ways of monitoring vagal function.

It appears that each NICU follows a different feeding protocol for the transition from NG tube feeding to oral feeding and a lack of global guidelines has been highlighted. Preferably the quicker this transition takes place, the better for the mother-infant dyad and their continuity of care.<sup>5</sup> Re-

cent articles identified that premature infants demonstrated a 'catch up' adiposity compared to term infants and this predisposed the infant to co-morbidities such as childhood obesity and cardiovascular disease.<sup>9</sup> This further highlights the importance of ensuring appropriate feeding in this group to support long-term health.

Sucking is an objective variable that NICU employees examine when making the decision to encourage an infant to oral independent feeding initially. A lot of work has been done in the last decade on examining the sucking dynamics of preterm infants and the improvements this pattern undergoes when transitioning from gavage feeding to oral feeding and breastfeeding.<sup>10,11</sup>

A difference between 'term' and 'preterm' infants' ability to create and maintain intra-oral vacuum has been observed. Not surprisingly, there was a significant difference identified in endurance and efficiency of feeding. The peak vacuum volume became weaker when the preterm infant sucked over time, demonstrating fatigue.<sup>10</sup> An "immature" suck is unable to have both successful suction and mouth expression. Immaturity relies on the expression alone to receive a feed.<sup>12</sup> This fails to actively use an intraoral negative pressure, the soft palate to close the airways effectively, and create a strong seal around the nipple.<sup>13</sup>

The World Health Organization (WHO) supports the exclusive use of breastfeeding for the first six months of life and suggests avoidance of any artificial teats during this time.<sup>14</sup> This reduces the likelihood of 'nipple confusion'<sup>15</sup> and increases the likelihood of breastfeeding continuity. However, this point does not appear to be applicable with preterm infants, as at around 15 weeks of intrauterine life, infants start to use 'Thumb sucking' as a form of NNS practice.<sup>15</sup> According to, 'The Ten Steps to Successful Breastfeeding' as part of the baby friendly hospital movement, endorsed by the World Health Organization and UNICEF, recommends NNS for improvement of neurodevelopment maturation in preterm infants.<sup>15</sup>

Understanding the benefits and drawbacks of NNS, clinicians would question when is an appropriate time to introduce nutritive suck to ensure a smooth start to breastfeeding. However, a lack of clear guidelines as to when and for how long NNS should be used is highlighted. As a result, a number of mothers use nipple shields to help initiate oral feeding as it requires less peak suck, and negative intra oral pressure to extract the milk, but this again can create potential 'nipple confusion' as it appears to take longer to create an organized suck swallow reflex in those infants.<sup>3</sup>

Based on this, the introduction of different artificial and non-artificial methods have been tested to see if any will facilitate the Sensory Motor Oral Stimulation (SMOS) and

suck-swallow-breath coordination (SSB) coordination. Lack of organized ability and rate of suck-swallow-breath reflex highlights that there is a neuro-developmental component that simply is not mature enough to safely allow these infants to swallow and process food effectively and further examination is needed in this domain.<sup>16</sup>

## Methods

A literature search of Pubmed, Science direct, Cochrane Library, WHO archives and NICE guidelines was undertaken from 2000 to May 2020 to identify articles that assessed the transition of gavage feeding to breastfeeding in premature infants. A variety of terms were used including MeSH Terms "enteral nutrition", "gavage tube feeding", "breast feeding", "premature", "oral-motor stimulation", "non-nutritional sucking."

*Inclusion criteria:* Articles in English language, published in peer reviewed journals including a multitude of disciplines who investigated premature infants less than 34 weeks of gestation.

*Exclusion criteria:* any other feeding devices than gavage feeding /naso-gastric tube used, premature infant with congenital anomalies, or ventilation support, older than 34 weeks gestation.

## Results

The final selection of articles included 11 studies, three systematic reviews, five RCTs, two cohort studies and one observational cross sectional study. These articles appeared to have the highest relevance to the area investigated.

In 2000, Premji and Paes examined all the available evidence and combined 11 RCTs that looked at the effect of use of pacifiers as part of SMOS method in improving coordination of SSB reflex and transition to oral feeding. However, the mean time of NNS used by each RCT varied from 5 to 30 minutes. The conclusion of the systematic review suggested the NNS supported the activation of more waking and alert states of the infant and increased GI motility prior to feeding. The meta-analysis of three RCT's all identified the decrease in mean hospitalization stay by weighted mean difference >5.9 days in the NNS group compared to the control group. No significant results were seen with respect to weight gain.<sup>17</sup>

Kaya et al., in 2016 showed that the pacifier group (NNS group) had significantly shorter hospitalization stays (434.50±133.29 hours) and transition to full oral feeding (123.06±66.56 hours) compared to the control group 593.63±385.32 and 167.78±91.77 hours, respectively) (p<0.05).<sup>18</sup>

Two other studies, a Cochrane<sup>19</sup> review and national cohort

study<sup>5</sup> supported the use of NNS as an avenue to transition to full oral feeding and also have identified an associated reduction in hospital stay. Collins et al. in 2003 and Maastrop et al. in 2014 identified that the use of NNS helped reduce the mean days spent in hospital by a range of mean difference of -4.59 to -9.3 days, respectively.

A Cochrane review by Foster et al. in 2016 identified that infants in the NNS group were able to fully transfer to oral feeding 5.51 days on average faster than the no intervention group (95% CI -8.20 to -2.82). This means that in real life population with similar characteristics to this sample are likely to also improve by transferring to oral feeding in 2.81 to 8.20 days faster if they use the NNS protocol. Additionally this had an impact on the decreased number of mean days of hospital stay by an average of 4.59 (95% CI -8.07 to -1.11; N= 501).<sup>4</sup> Their review highlighted that no adverse effects were associated with the use of Sensory motor oral stimulation and the use of NNS.

Lubbe et al. in 2017 justified the use of NNS in baby friendly hospitals in preterm infants because it aided the development and organization of the suck—swallow-breath reflex and also was considered safe.

Another study used motorized pacifiers to strengthen the use of NNS in conjunction with gavage feeding in an attempt to amplify the response.<sup>20</sup> They identified a reduction in time needed to achieve first oral feed and full oral feeding with this intervention, as well achieving a full day's early discharge compared to the control group.<sup>20</sup>

Some studies investigated the implication of multiple stimuli (Audible, Tactile, Visual, Vestibular (ATVV) designed to enhance at a neurological level and summate the results of Sensory Motor Oral Stimulation to try and improve the infants' transition to feeding and reduce hospitalization stay.<sup>21</sup> In 2016, Medoff-Cooper et al, used the ATVV protocol instead of the NNS protocol and demonstrated that it appeared to give preterm infants a stronger number of sucks and mean suck per burst compared to the no intervention group. This included a sudden increase in sucking ability by day seven of intervention and a plateau (with no further improvement) by 14 days. The control group needed 14 days to achieve the same ability to orally feed as the intervention group who made this achievement in half the time. These results had a statistical significance at  $p < 0.01$  and are likely to be applicable to infants in real life with similar characteristics to the sample group. This identified an important area for further research as an early multi-stimulus intervention appeared to have a positive effect on the correct integration with oral feeding.

Medoff—Cooper, et al 2000 observed that although the NNS improves over time the coordination of the suck swal-

low breath reflex, the relation is not directly linear or directly seen when translated to nutritive suck (oral feeding) as nutritive suck requires more effort and the infant needs to practice this further. Some infants were too stressed to manage both actions of suck-swallow and dealing with environmental stressors (bright light, noise etc.), although they were able to use a pacifier.<sup>21</sup>

Perhaps future studies can be done comparing AVTT to NNS and also combining the two methods to examine their cost effectiveness and best ways to improve the transition from enteric to oral feeding.

Say, in 2018 identified in two groups the pacifier (NNS) and control group that the transition time to full oral feeding was very similar in both bottle (38 — 19.2 days), and breast-fed infants (38.1 — 20 days). However the time needed for hospital discharge (48.4 — 19.2 days) in the NNS group were significantly shorter compared with the control group (65.3 — 30.6 days). These findings were statistically significant and are likely to be applicable to infants outside the study ( $p < 0.05$ ).<sup>19</sup>

Other studies have shown that the longer infants were on NNS, the less likely they were to go on to exclusive breast feeding.<sup>5,6,10</sup> Specifically, Maastrop et al. in 2014 identified that the earlier the infants reduced the use of a pacifier and practiced breastfeeding the quicker exclusive breastfeeding was established (mean of 2 days (95% CI 0.1—2.3)).<sup>5</sup>

The Younesian et al, 2015 RCT included 20 infants and looked at the use of oral-motor stimulation as part of the transition protocol from gavage to oral feeding.<sup>22</sup> The use of touch, sensory, motor stimulation 20-40 minutes before feeding was encouraged whereas the control did not have this. A significant difference in achieving oral feeding was seen in the intervention group which achieved this by day 13. The control group needed 26 days. Similarly, the intervention group was discharged quicker than the control group at 32 days compared to 38 in the control group. The results were impressive, but involved a very small sample.

## Discussion

The goal of this review was to better understand how premature infants develop their feeding skills. Neiva et al, explained NNS as an oral motor skill that precedes feeding,<sup>23</sup> and the inability to orally feed at this time should not be considered an illness but rather a lack of maturation of such processes.<sup>6</sup>

As chiropractors, there is little or no interaction at this stage with premature infants and NICU decisions on the feeding protocol. However, ensuring adequate knowledge and clinical understanding of potential issues that can arise secondary to gavage feeding (i.e. mouth sensitivity, gag reflex

hypersensitivity) is paramount. This may be reflected when advising parents and answering their questions (i.e. positional preference in NICU, developmental plagiocephaly secondary to supine sleep, feeding positions) along with potential facilitation of breastfeeding as the baby matures. In addition, when treating these infants upon their hospital discharge, there is a need to understand and account for potential neurodevelopmental delay (disorganized SSB, altered primitive reflexes, etc.).

In fact, breastfeeding issues can become an indicator for infant neurodevelopment status, and can become an issue later for successful establishment of mastication or speech and language development. Lau (2014) proposed and explained the two-part 'Nutritive suck pathway.' The first part includes suck-pharyngeal—swallow-respiration phase and the second, suck-pharyngeal-swallow-esophageal reflex. This highlights that part-one does not activate the esophagus nor activates the associated musculature and thus does not participate in peristalsis. Given the fact that NNS does not employ both pathways, it appears that the infant does not get the necessary exposure to facilitate improvement utilizing only one method. Thus an appropriate introduction of feeding is encouraged to facilitate development. In fact, studies showed that an early reduction of NNS encouraged exclusive breastfeeding.<sup>5,6,10</sup>

As such, there is evidence that NNS demonstrates maintenance and longer support for awake/alertness stages as well as increase in gut motility and production of hunger hormones in the baby who is gavage fed. These factors facilitate an increase of enzymatic activity and preparation for better gut motility.<sup>20</sup> All of this is useful for transition to routine feeding. Similarly, the 2019 Non Nutritive Sucking Neonatal Clinical Guideline by NHS stated that pacifiers should be used 5-10 minutes before a tube feed, as well as during and after tube feeding.<sup>24</sup> Lau et al, in 2014 made a valid point that although maturation of NNS is positively associated with reducing the length of hospital stays, it does not have the same pathway as oral feeding and therefore, may not stand alone.<sup>25</sup> That said, there is an impressive reduction in days of hospital stays associated with NNS.

Although the suck swallow breath reflex is slower in preterm infants, it facilitates the activation of muscle tone. Neurologically this reflex requires both synergy and coordination of facial muscles, muscles of mastication, tongue and musculature of the soft palate. Thus practice of NNS mimics partially the activation process of suck-swallow reflex, but does not allow total control of this process. This is, of course, because there is a bolus bulk in nutritive suck which is not present in NNS. According to Pineda et al. in 2019,<sup>26</sup> preterm infants will increase the strength of intraoral pressure over time and when the plateau of strength is reached and the infant is able to maintain the same strength

over time, then that is the more likely the time to be able to successfully introduce breastfeeding safely.

Further, the readiness of a preterm infant to transition to oral feeding should not be made only based on stable vital signs but also based on the ability to maintain a strong vacuum and sucking pressure.<sup>27</sup> Due to the fact that the infant natural swallow reflex matures around the age of 36 weeks of gestation and given the apparent trend between strength of suck and maturation of the suck-swallow-breath reflex, more studies are needed to examine when (time paradigm) to reach the maximum intraoral pressure in a timely manner so that oral feeding, particularly breastfeeding can be successfully introduced.

Based on the identified literature, there is sufficient evidence to support recommending that caregivers of premature infants are encouraged to use frequent sensory (touch, skin to skin, music, milk odor), motor (gentle rocking, change in sleeping position) stimulation and NNS (on empty breast, gloved finger and pacifier) as these reduce potential hypersensitization and strengthens the neurological maturation to achieve the necessary practice to start oral feeding. However, although there is a positive trend of oral stimulation and non-nutritive suck with hospitalization discharge, it is not synonymous with weight gain and thus close observation of these infants is required. However, the American Academy of Pediatrics (AAP) in a policy statement suggested that the major criteria for discharge from NICU is independent oral feeding (AAP Policy Statement, 2008)<sup>3</sup> because this demonstrates the neurological maturity of medullary brain area as well as the processing pathways. Each article had a different approach to measuring improvement of feeding ranging from onset of oral feeding to full oral feeding to the day of discharge, weight gain and vital signs. A consistent approach is required.

This review looked at the effect of NNS as part of SMOS and its effect on bettering nutritive suck and transition from gavage to oral feeding, with a preference for breastfeeding. Although a positive trend appears to exist between NNS and improvement on oral feeding, there is not clear proof that NNS facilitates the transition from gavage feeding to exclusive breastfeeding. This could be due to the variation observed in the amount/active time of NNS introduction and differing procedures used for feeding assessments.

## Conclusion

There is a small but growing amount of evidence to support early intervention with multiple sensory/motor stimuli and non-nutritive suck in an attempt to create neurological central summation and maturation of the suck-swallow-breathing reflex that can lead to independent feeding in preterm infants before 34 weeks of age. Based on the literature considered in this document, non-nutritive suck

and sensory-motor oral stimulation do not appear to hinder breastfeeding transition nor has it been found to cause adverse effects. There is some evidence that these procedures are linked to earlier hospital discharge and successful breastfeeding as early as bottle feeding. However, the evidence is not conclusive and therefore this particular area needs further research and global cohesive guidelines in an attempt to establish a common basic protocol that could be employed in all NICU for a swift transition and documentation of gavage feeding to oral feeding.

As chiropractors we have a duty to assess the musculoskeletal structure of these infants in order to better support exclusive breastfeeding following their discharge from the hospital.

Abbreviation	Full Name
NNS	Non nutritive suck
N S	Nutritive suck
SSB	Suck swallow breath
BF	Breastfeeding
NG Tube	Nasogastric tube
WHO	World World Health Organization
NICU	Neonatal intensive care unit

**Appendix 1: Abbreviation List.**

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## Demographic profile of chiropractors who treat children: A multinational survey

Matthew F. Doyle, MSc, Joyce E. Miller, DC, PhD

*Journal of Manipulative and Physiological Therapeutics*, Volume 42, Issue 1, January 2019, Pages 1-11

### ABSTRACT

**Objective:** The purpose of this study was to survey the demographic profile and educational background of chiropractors with pediatric patients on a multinational scale. **Methods:** A multinational online cross-sectional demographic survey conducted over a 15-day period in July 2010. The survey was electronically administered via chiropractic associations in 17 countries, using SurveyMonkey for data acquisition, transfer, and descriptive analysis. **Results:** The response rate was 10.1%, and 1498 responses were received from 17 countries on 6 continents. Of these, 90.4% accepted pediatric cases. The average practitioner was male (61.1%) and 41.4 years old, had 13.6 years in practice, and saw 107 patient visits per week. Regarding educational background, 63.4% had a bachelor's degree or higher in addition to their chiropractic qualification, and 18.4% had a postgraduate certificate or higher in pediatric chiropractic. **Conclusion:** This is the first study about chiropractors who treat children from the United Arab Emirates, Peru, Japan, South Africa, and Spain. Although the response rate was low, the results of this multinational survey suggest that pediatric chiropractic care may be a common component of usual chiropractic practice on a multinational level for these respondents.

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## The safety of spinal manipulative therapy in children under 10 years: a rapid review

Corso M., Cancelliere C., Mior S., Taylor-Vaisey A., Côté P

*BMC Complement Med Ther.*, January 15, 2020; 20(1):12. doi: [10.1186/s12906-019-2803-2](https://doi.org/10.1186/s12906-019-2803-2)

### ABSTRACT

**INTRODUCTION:** The safety of spinal manipulative therapy (SMT) in children is controversial. We were mandated by the College of Chiropractors of British Columbia to review the evidence on this issue. **OBJECTIVES:** We conducted a rapid review of the safety of SMT in children (<10 years). We aimed to: 1) describe adverse events; 2) report the incidence of adverse events; and 3) determine whether SMT increases the risk of adverse events compared to other interventions. **EVIDENCE REVIEW:** We searched MEDLINE, CINAHL, and Index to Chiropractic Literature from January 1, 1990 to August 1, 2019. We used rapid review methodology recommended by the World Health Organization. Eligible studies (case reports/series, cohort studies and randomized controlled trials) were critically appraised. Studies of high and acceptable methodological quality were included. The lead author extracted data. Data extraction was independently validated by a second reviewer. We conducted a qualitative synthesis of the evidence. **FINDINGS:** Most adverse events are mild (e.g., increased crying, soreness). One case report describes a severe adverse event (rib fracture in a 21-day-old) and another an indirect harm in a 4-month-old. The incidence of mild adverse events ranges from 0.3% (95% CI: 0.06, 1.82) to 22.22% (95% CI: 6.32, 54.74). Whether SMT increases the risk of adverse events in children is unknown. **CONCLUSION:** The risk of moderate and severe adverse events is unknown in children treated with SMT. It is unclear whether SMT increases the risk of adverse events in children <10 years.

**KEYWORDS:** Adverse event; Child; Pediatric; Safety; Spinal manipulation; Spinal mobilization.

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## Chiropractic care of the pregnant woman and neonate

Erin Curnow, Sadie Geraghty

*British Journal of Midwifery*, May 2, 2019 <https://doi.org/10.12968/bjom.2019.27.5.284>

Full article can be accessed by requesting a copy at: [https://www.researchgate.net/publication/332827266\\_Chiropractic\\_care\\_of\\_the\\_pregnant\\_woman\\_and\\_neonate](https://www.researchgate.net/publication/332827266_Chiropractic_care_of_the_pregnant_woman_and_neonate)

### ABSTRACT

The history and values of the chiropractic profession are part of the complementary and alternate medicine model. Chiropractic care in pregnancy is used for relief of back pain, turning breech presenting fetuses, and treatment of colic, breastfeeding and constipation issues in the neonate.

## Added sugars intake among US infants and toddlers

Herrick KA, Fryar CD, Hamner HC, Park S, Ogden CL.

*J Acad Nutr Diet*, 2020 Jan;120(1):23-32. doi:[10.1016/j.jand.2019.09.007](https://doi.org/10.1016/j.jand.2019.09.007). Epub 2019 Nov 14.

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### ABSTRACT

**BACKGROUND:** Limited information is available on added sugars consumption in US infants and toddlers. **OBJECTIVES:** To present national estimates of added sugars intake among US infants and toddlers by sociodemographic characteristics, to identify top sources of added sugars, and to examine trends in added sugars intake. **DESIGN:** Cross-sectional analysis of 1 day of 24-hour dietary recall data. **PARTICIPANTS/SETTING:** A nationally representative sample of US infants aged 0 to 11 months and toddlers aged 12 to 23 months (n=1,211) during the period from 2011 through 2016 from the National Health and Nutrition Examination Survey. Trends were assessed from 2005-2006 through 2015-2016 (n=2,795). **MAIN OUTCOME MEASURES:** Among infants and toddlers, the proportion consuming any added sugars, the average amount of added sugars consumed, percent of total energy from added sugars, and top sources of added sugars intake. **STATISTICAL ANALYSIS:** Paired t tests were used to compare differences by age, sex, race/Hispanic origin, family income level, and head of household education level. Trends were tested using orthogonal polynomials. Significance was set at P<0.05. **RESULTS:** During 2011 to 2016, 84.4% of infants and toddlers consumed added sugars on a given day. A greater proportion of toddlers (98.3%) consumed added sugars than infants (60.6%). The mean amount of added sugars toddlers consumed was also more compared with infants (5.8 vs 0.9 tsp). Non-Hispanic black toddlers (8.2 tsp) consumed more added sugars than non-Hispanic Asian (3.7 tsp), non-Hispanic white (5.3 tsp), and Hispanic (5.9 tsp) toddlers. A similar pattern was observed for percent energy from added sugars. For infants, top sources of added sugars were yogurt, baby food snacks/sweets, and sweet bakery products; top sources among toddlers were fruit drinks, sugars/sweets, and sweet bakery products. The mean amount of added sugars decreased from 2005-2006 through 2015-2016 for both age groups; however, percent energy from added sugars only decreased among infants. **CONCLUSION:** Added sugars intake was observed among infants/toddlers and varied by age and race and Hispanic origin. Added sugars intake, as a percent of energy, decreased only among infants from 2005 to 2016.

**KEYWORDS:** Added sugars; Infants; Nutrition; Survey; Toddlers

## Clinical consensus statement: Ankyloglossia in children

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*Otolaryngology—Head and Neck Surgery*, <https://doi.org/10.1177/0194599820915457>

First published: April 14, 2020

### ABSTRACT

**Objective:** To identify and seek consensus on issues and controversies related to ankyloglossia and upper lip tie in children by using established methodology for American Academy of Otolaryngology—Head and Neck Surgery clinical consensus statements. **Methods:** An expert panel of pediatric otolaryngologists was assembled with nominated representatives of otolaryngology organizations. The target population was children aged 0 to 18 years, including breastfeeding infants. A modified Delphi method was used to distill expert opinion into clinical statements that met a standardized definition of consensus, per established methodology published by the American Academy of Otolaryngology—Head and Neck Surgery. **Results:** After 3 iterative Delphi method surveys of 89 total statements, 41 met the predefined criteria for consensus, 17 were near consensus, and 28 did not reach consensus. The clinical statements were grouped into several categories for the purposes of presentation and discussion: ankyloglossia (general), buccal tie, ankyloglossia and sleep apnea, ankyloglossia and breastfeeding, frenotomy indications and informed consent, frenotomy procedure, ankyloglossia in older children, and maxillary labial frenulum. **Conclusion:** This expert panel reached consensus on several statements that clarify the diagnosis, management, and treatment of ankyloglossia in children 0 to 18 years of age. Lack of consensus on other statements likely reflects knowledge gaps and lack of evidence regarding the diagnosis, management, and treatment of ankyloglossia. Expert panel consensus may provide helpful information for otolaryngologists treating patients with ankyloglossia.

**Keywords:** Ankyloglossia, tongue-tie, lip tie, frenotomy, frenuloplasty, lingual frenulum, frenectomy, frenulotomy, frenuloplasty, maxillary labial frenulum, maxillary frenotomy, breastfeeding.

## The role of nutrition in asthma prevention and treatment

Jihad Alwarith, Hana Kahleova, Lee Crosby, Alexa Brooks, Lizoralia Brandon, Susan M Levin, Neal D Barnard  
*Nutrition Reviews*, nuaa005, <https://doi.org/10.1093/nutrit/nuaa005>  
Published March 13, 2020.

### ABSTRACT

Asthma is a chronic respiratory condition characterized by airway inflammation and hyperreactivity. Prevalence has continued to rise in recent decades as Western dietary patterns have become more pervasive. Evidence suggests that diets emphasizing the consumption of plant-based foods might protect against asthma development and improve asthma symptoms through their effects on systemic inflammation, oxidation, and microbial composition. Additionally, increased fruit and vegetable intake, reduced animal product consumption, and weight management might mediate cytokine release, free radical damage, and immune responses involved in the development and course of asthma. The specific aim of this review paper is to examine the current literature on the associations between dietary factors and asthma risk and control in children and adults. Clinical trials examining the mechanism(s) by which dietary factors influence asthma outcomes are necessary to identify the potential use of nutritional therapy in the prevention and management of asthma.

**KEYWORDS:** Asthma, diet, inflammation, plant-based, vegan.

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## The effects of early nutritional interventions on the development of atopic disease in infants and children: The role of maternal dietary restriction, breastfeeding, hydrolyzed formulas, and timing of introduction of allergenic complementary foods

Frank R. Greer, Scott H. Sicherer, A. Wesley Burks, COMMITTEE ON NUTRITION and SECTION ON ALLERGY AND IMMUNOLOGY  
*Pediatrics*, April, 2019, 143 (4) e20190281; DOI: <https://doi.org/10.1542/peds.2019-0281>  
Full paper Accessed at: <https://pediatrics.aappublications.org/content/143/4/e20190281>

### ABSTRACT

This clinical report updates and replaces a 2008 clinical report from the American Academy of Pediatrics, which addressed the roles of maternal and early infant diet on the prevention of atopic disease, including atopic dermatitis, asthma, and food allergy. As with the previous report, the available data still limit the ability to draw firm conclusions about various aspects of atopy prevention through early dietary interventions. Current evidence does not support a role for maternal dietary restrictions during pregnancy or lactation. Although there is evidence that exclusive breastfeeding for 3 to 4 months decreases the incidence of eczema in the first 2 years of life, there are no short- or long-term advantages for exclusive breastfeeding beyond 3 to 4 months for prevention of atopic disease. The evidence now suggests that any duration of breastfeeding  $\geq 3$  to 4 months is protective against wheezing in the first 2 years of life, and some evidence suggests that longer duration of any breastfeeding protects against asthma even after 5 years of age. No conclusions can be made about the role of breastfeeding in either preventing or delaying the onset of specific food allergies. There is a lack of evidence that partially or extensively hydrolyzed formula prevents atopic disease. There is no evidence that delaying the introduction of allergenic foods, including peanuts, eggs, and fish, beyond 4 to 6 months prevents atopic disease. There is now evidence that early introduction of peanuts may prevent peanut allergy.

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## Pediatric Spine Disorders

DePaola K and Cuddihy LA  
*Pediatr Clin North Am.*, 2020 Feb;67(1):185-204. doi: 10.1016/j.pcl.2019.09.008.  
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### ABSTRACT

Pediatric spine disorders are numerous and are quite different when compared with the adult population. This article focuses on some of the more common pediatric spine disorders. This article summarizes such disorders and discusses typical treatment options in the pediatric orthopedic armamentarium.

**KEYWORDS:** Adolescent idiopathic scoliosis; Back pain; Congenital scoliosis; Early onset scoliosis; Juvenile scoliosis; Scheurmann kyphosis; Spondylolisthesis; Spondylolysis.

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## Effectiveness of craniosacral therapy in the treatment of infantile colic. A randomized controlled trial

Castejón-Castejón M, Murcia-González MA, Martínez Gil JL, Todri J, Suárez Rancel M, Lena O4, Chillón-Martínez R. *Complement Med Ther.*, December, 2019 doi:[10.1016/j.ctim.2019.07.023](https://doi.org/10.1016/j.ctim.2019.07.023). Epub 2019 Aug 13. Copyright © 2019. Published by Elsevier Ltd.

### ABSTRACT

**OBJECTIVES:** To determine the effectiveness of Craniosacral Therapy (CST) for the treatment of infantile colic. **MATERIAL AND METHODS:** This randomized controlled trial was conducted on 58 infants, aged 0-84 days, diagnosed with infantile colic. The babies received a 30-40 minute CST session once a week (experimental group) or no treatment (control group). Babies in the CST group received either 1, 2 or 3 CST sessions over a 14-day period. Data were collected at 4 different times over the 24-day period, day 0 (baseline), day 7, day 14 and day 24. Crying (primary outcome) and sleep (secondary outcome) were evaluated using a crying and sleep diary, and colic severity was measured using the Infant Colic Severity Questionnaire (secondary outcome). **RESULTS:** There was a statistically significant difference between groups (CST and control) in crying hours ( $F = 188.47$ ;  $p < 0.0005$ ;  $\eta^2 = 0.78$ ), sleep hours ( $F = 61.20$ ;  $p < 0.0005$ ,  $\eta^2 = 0.54$ ) and colic severity ( $F = 143.74$ ;  $p < 0.0005$ ,  $\eta^2 = 0.73$ ) across all the time points. In comparison with the control group, CST babies reported significant and clinically relevant effects in crying hours on day 7 (-2.47 h (95%CI, -2.95 to -1.99);  $p < 0.0005$ ;  $d = 1.73$ ), on day 14 (-3.29 h (95%CI, -3.7 to -2.8);  $p < 0.0005$ ;  $d = 2.87$ ) and on day 24 (-3.20 h (95%CI, -3.7 to -2.6);  $p < 0.0005$ ;  $d = 2.54$ ); in sleep hours on day 7 (-2.47 h (95%CI, -2.95 to -1.99);  $p < 0.0005$ ;  $d = 1.73$ ) on day 14 (-3.29 h (95%CI, -3.7 to -2.8);  $p < 0.0005$ ;  $d = 2.87$ ) and on day 24 (-3.20 h (95%CI, -3.7 to -2.6);  $p < 0.0005$ ;  $d = 2.54$ ). **CONCLUSIONS:** Craniosacral therapy appears to be effective and safe for infantile colic by reducing the number of crying hours, the colic severity and increasing the total hours of sleep.

## Surface Electromyographic Analysis of the Suprahyoid Muscles in Infants Based on Lingual Frenulum Attachment during Breastfeeding

Ellia Christinne Lima França, Lucas Carvalho Aragão Albuquerque, Roberta Lopes de Castro Martinelli, Ilda Machado Fiuza Gonçalves, Cejana Baiocchi Souza and Maria Alves Barbosa  
*Int. J. Environ. Res. Public Health*, 2020, 17(3), 859; <https://doi.org/10.3390/ijerph17030859>  
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### ABSTRACT

Muscle electrical activity analysis can aid in the identification of oral motor dysfunctions, such as those resulting from an altered lingual frenulum, which consequently impairs feeding. Here, we aim to analyze the suprahyoid muscle electrical activity of infants via surface electromyography, based on lingual frenulum attachment to the sublingual aspect of the tongue and floor of the mouth during breastfeeding. In the present study, we have studied full-term infants of both genders, aged between 1 and 4 months old. The mean muscle activities were recorded in microvolts and converted into percent values of the reference value. Associations between the root mean square and independent variables were tested by one-way analysis of variance and Student's t-test, with a significance level of 5% and test power of 95%, respectively. We evaluated 235 infants. Lower mean muscle electrical activity was observed with the lingual frenulum attached to apex/lower alveolar ridge, followed by attachment to the middle third/lower alveolar ridge, and between the middle third and apex/lower alveolar ridge. Greater suprahyoid muscle activity was observed with lingual frenulum attachment to the middle third of the tongue/sublingual caruncles, showing a coordination between swallowing, sucking, and breathing. Surface electromyography is effective in diagnosing lingual frenulum alterations, the attachment points of which raises doubt concerning the restriction of tongue mobility. Thus, it is possible to identify oral motor dysfunctions. View Full-Text

**Keywords:** lingual frenulum; tongue tie; electromyography; suprahyoid muscles; breastfeeding.

## Milk and Health

Walter C. Willett, M.D., Dr.P.H., and David S. Ludwig, M.D., Ph.D.  
*New England Journal of Medicine*, <https://www.nejm.org/doi/full/10.1056/NEJMra1903547>

### ABSTRACT

This review summarizes the evidence for the benefits and possible risks associated with consumption of cow's milk. The authors describe the relationship of milk consumption to the risks of fracture, obesity, cardiovascular disease, allergies, and various cancers.

## Breakfast consumption, family breakfast, and adiposity trajectory in adolescence – The adolescent nutritional assessment longitudinal cohort study

Hassan BK, Cunha DB, da Veiga GV, Pereira RA, Hoffman DJ and Sichieri R.

*J Acad Nutr Diet.*, 2019 Jun;119(6):944-956. doi:[10.1016/j.jand.2018.11.014](https://doi.org/10.1016/j.jand.2018.11.014). Epub 2019 Feb 8

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### ABSTRACT

**Background:** The relationship between breakfast and family breakfast and adiposity gain during adolescence remains inconclusive. **OBJECTIVE:** This study aimed to investigate the relationship between breakfast and family breakfast frequency and adiposity trajectory in adolescence. **DESIGN:** Prospective cohort study with middle school students aged 10 to 16 years enrolled in 2010 (baseline) and followed for 3 years. **PARTICIPANTS/SETTING:** A total of 945 students from two public and four private schools in the metropolitan area of Rio de Janeiro were included. Among 945 students, 809 participated in the study at baseline. Pregnant or lactating students and those with physical or mental disabilities were excluded. **MAIN OUTCOME MEASURES:** Body mass index (BMI) was assessed by measuring the participants' weight and height, and percent body fat (%BF) was assessed by performing bioelectrical impedance analysis. **STATISTICAL ANALYSES PERFORMED:** Linear mixed-effect models were used to examine the relationship between baseline and persistence of breakfast consumption and family breakfast over a 3-year period and change in BMI and %BF. Breakfast and family breakfast were assessed by questions on frequency of consumption. Both variables were classified as regular, intermediate, and no consumption at baseline. Persistence was divided into persistently regular, persistently irregular, changing from regular to irregular, and contrariwise. **RESULTS:** Overall, frequent breakfast consumption and family breakfast did not have protective effects against adiposity. At baseline, these behaviors were associated with low BMI and %BF among girls. During follow-up, these behaviors and persistence of regular breakfast consumption were associated with an increase in %BF ( $P < 0.05$ ). In boys, those who increased or decreased family breakfast frequency had greater decrease in %BF compared with those persistently regular at both time points. **CONCLUSION:** Breakfast had no consistent relationship with adolescence adiposity trajectory, which is in line with the results of experimental studies and in contrast with those of many cross-sectional studies.

**KEYWORDS:** Adiposity; Adolescents; Breakfast frequency; Cohort studies; Family breakfast frequency.

## Adherence to timely vaccinations in the United States

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### ABSTRACT

**OBJECTIVES:** To estimate (1) the proportion of children not adhering to the Advisory Committee on Immunization Practices (ACIP) recommended early childhood immunization schedule and (2) associations between schedule adherence, sociodemographic characteristics, and up-to-date immunization status by 19 to 35 months of age. **METHODS:** We used 2014 National Immunization Survey provider-verified vaccination data to classify vaccination patterns as “recommended” (ie, in line with ACIP dose- and age-specific recommendations), “alternate” (ie, in line with either limiting the number of shots per visit or skipping at least 1 vaccine series), or “unknown or unclassifiable” (ie, not in line with ACIP recommendations or clearly limiting shots per visit or vaccine series). We evaluated the association between vaccination patterns and up-to-date status for all ACIP-recommended vaccinations (including rotavirus and hepatitis A vaccines) using Poisson regression. **RESULTS:** The majority of children's patterns were classified as “recommended” (63%), with 23% and 14% following alternate or unknown or unclassifiable patterns, respectively; 58% of children were up-to-date with all ACIP-recommended immunizations by 19 to 35 months. Not being up-to-date was associated with alternate (prevalence ratio = 4.2, 95% confidence interval: 3.9–4.5) and unknown or unclassifiable (prevalence ratio = 2.4, 95% confidence interval: 2.2–2.7) patterns. **CONCLUSIONS:** High vaccine coverage by 19 to 35 months of age may miss nonadherence to the recommended immunization schedule in the first 18 months of life, leaving children vulnerable to preventable diseases. With more than one-third of US children not following the ACIP schedule, targeted interventions are needed to minimize vaccine delays and disease susceptibility.

## Changes in motor skill proficiency after equine-assisted activities and brain-building tasks in youth with neurodevelopmental disorders

B. Rhett Rigby, Ronald W. Davis, Melissa D. Bittner, Robin W. Harwell, Eileen J. Leek, Geoben A. Johnson and David L. Nichols  
*Front. Vet. Sci.*, 31 January 2020 <https://doi.org/10.3389/fvets.2020.00022>

### ABSTRACT

There is a lack of current research to support the efficacy of a combination of equine-assisted activities (EAA) and brain building activities to influence motor skill competencies in youth with neurodevelopmental disorders (ND). The primary objective of this study was to quantify changes in motor skill proficiency before and after 8 weeks of EAA and brain-building activities in youth with ND. A secondary objective was to quantify changes in motor skill proficiency before and after 1 year of EAA and brain-building activities in youth with ND. Twenty-five youth completed the same 32-week protocol that was separated into 4, 8-week blocks, in the following order: (1) control; (2) EAA-only; (3) washout; (4) GaitWay block (EAA and brain building activities). Before and after each block, motor skills were assessed using the Short Form of the Bruininks-Oseretsky Test of Motor Proficiency-Version 2 (BOT-2). Seven youth continued with the GaitWay intervention for one additional year, and the BOT-2 Short Form was also administered following this intervention. A repeated-measures analysis-of-variance was performed to compare BOT-2 subtest and overall scores between interventions with a significance of 0.05. Manual dexterity was higher at Post-Washout [3.3 (2.4)] vs. Pre-Control [2.2 (2.1);  $p = 0.018$ ] and Post-Control [2.6 (2.0);  $p = 0.024$ ], and at Post-GaitWay vs. Pre-Control [3.2 (2.4) vs. 2.2 (2.1);  $p = 0.037$ ]. Upper-limb coordination was higher at Post-GaitWay vs. Post-Control [6.0 (4.1) vs. 3.9 (3.8);  $p = 0.050$ ]. When compared to Pre-Control [3.2 (3.0)], strength was higher at Post-EAA [4.9 (3.5);  $p = 0.028$ ] and at Post-GaitWay [5.2 (2.9);  $p = 0.015$ ]. Overall scores were higher at Post-GaitWay [39.1 (22.2)] when compared to Pre-Control [32.4 (21.6);  $p = 0.003$ ] and Post-Control [32.5 (21.9);  $p = 0.009$ ]. Additionally, motor skills were maintained for 1 year following the Post-GaitWay testing session among seven participants. This is the first known study to include and demonstrate the short-term and long-term effects of a combination of EAA and brain building activities with motor proficiency in youth with ND.

**Clinical Trial Registration:** Motor Skill Proficiency After Equine-Assisted Activities and Brain-building Tasks; [www.ClinicalTrials.gov](http://www.ClinicalTrials.gov), identifier: NCT04158960.

## Dairy, soy, and risk of breast cancer: those confounded milks

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*International Journal of Epidemiology*, dyaa007, <https://doi.org/10.1093/ije/dyaa007>  
 Published February 25, 2020.

### ABSTRACT

**Background:** Associations between soy, dairy intakes and breast cancer risk are inconsistent. No studies exist with large numbers of dairy consumers and soy consumers to assess mutual confounding. **Methods:** The study cohort contains 52 795 North American women, initially free of cancer, followed for 7.9 years (29.7% were Black). Dietary intakes were estimated from food frequency questionnaires and, for 1011 calibration study subjects, from six structured 24-h dietary recalls. Incident invasive breast cancers were detected mainly by matching with cancer registries. Analyses used multivariable proportional hazards regression. **Results:** The participants (mean age of 57.1 years) experienced 1057 new breast cancer cases during follow-up. No clear associations were found between soy products and breast cancer, independently of dairy. However, higher intakes of dairy calories and dairy milk were associated with hazard ratios (HRs) of 1.22 [95% confidence interval (CI): 1.05–1.40] and 1.50 (95% CI 1.22–1.84), respectively, comparing 90th to 10th percentiles of intakes. Full fat and reduced fat milks produced similar results. No important associations were noted with cheese and yogurt. Substituting median intakes of dairy milk users by those of soy milk consumers was associated with HR of 0.68 (95% CI: 0.55–0.85). Similar-sized associations were found among pre- and post-menopausal cases, with CIs also excluding the null in estrogen receptor (ER+, ER-), and progesterone receptor (PR+) cancers. Less biased calibrated measurement-error adjusted regressions demonstrated yet stronger, but less precise, HRs and CIs that still excluded the null. **Conclusions:** Higher intakes of dairy milk were associated with greater risk of breast cancer, when adjusted for soy intake. Current guidelines for dairy milk consumption could be viewed with some caution.

**KEYWORDS:** Soy isoflavones, soy intake, meat analogues, soy milk, tofu, breast cancer, Western population.

## Health impacts of early complementary food introduction between formula-fed and breastfed infants

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*J Pediatr Gastroenterol Nutr.* 2020 Mar;70(3):375-380. doi:[10.1097/MPG.0000000000002581](https://doi.org/10.1097/MPG.0000000000002581).

### ABSTRACT

**BACKGROUND:** Global health agencies agree that infants should not be fed complementary foods before 4 to 6 months of age. However, given the World Health Organization (WHO) definition of complementary food as “anything other than breast milk,” little is known about the relative risks of formula compared with other complementary foods on infant health. This article aims to fill this gap in the literature, by assessing how differences in the timing of the introduction of nonformula complementary food between breastfed and formula-fed infants impacts infant health. **METHODS:** Eight health outcomes by complementary food introduction, breast-feeding, formula feeding, and mixed feeding (breastfed and formula-fed) were predicted using logistic regression with generalized estimating equations on the newborn through 6-month waves of the Infant Feeding Practices Study II (IFPS-II). **RESULTS:** Complementary foods increased the likelihood for all health risks measured. Given greater prevalence of early complementary food introduction among formula-fed infants, most health differences between breast-feeding groups shift to nonsignificance in full models, with the exception of higher rates of hard stool and cough/wheeze among formula-fed and mixed-fed infants but lower rates of diarrhea (LO=-0.577; 95% confidence interval [CI]=-1.074 to 0.080) and runny nose or cold (LO=-3.19; 95% CI=-0.552 to -0.086) for mixed-fed than breastfed infants. **CONCLUSIONS:** Our results confirm health benefits of exclusive breast-feeding and that the introduction of complementary foods before 4 to 6 months poses a greater risk to infant health than does formula. Greater attention to the early introduction of complementary foods is needed in research and clinical practice.

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## Therapeutic use of cannabis and cannabinoids: an evidence mapping and appraisal of systematic reviews

Montero-Oleas N, Arevalo-Rodríguez I, Nuñez-González S, Viteri-García A and Simancas-Racines D.

*BMC Complementary Medicine and Therapies*, 20, Article number: 12 (2020) <https://doi.org/10.1186/s12906-019-2803-2>

Published January 15, 2020.

### ABSTRACT

**Background:** Although cannabis and cannabinoids are widely used with therapeutic purposes, their claimed efficacy is highly controversial. For this reason, medical cannabis use is a broad field of research that is rapidly expanding. Our objectives are to identify, characterize, appraise, and organize the current available evidence surrounding therapeutic use of cannabis and cannabinoids, using evidence maps. **Methods:** We searched PubMed, EMBASE, The Cochrane Library and CINAHL, to identify systematic reviews (SRs) published from their inception up to December 2017. Two authors assessed eligibility and extracted data independently. We assessed methodological quality of the included SRs using the AMSTAR tool. To illustrate the extent of use of medical cannabis, we organized the results according to identified PICO questions using bubble plots corresponding to different clinical scenarios. **Results:** A total of 44 SRs published between 2001 and 2017 were included in this evidence mapping with data from 158 individual studies. We extracted 96 PICO questions in the following medical conditions: multiple sclerosis, movement disorders (e.g. Tourette Syndrome, Parkinson Disease), psychiatry conditions, Alzheimer disease, epilepsy, acute and chronic pain, cancer, neuropathic pain, symptoms related to cancer (e.g. emesis and anorexia related with chemotherapy), rheumatic disorders, HIV-related symptoms, glaucoma, and COPD. The evidence about these conditions is heterogeneous regarding the conclusions and the quality of the individual primary studies. The quality of the SRs was moderate to high according to AMSTAR scores. **Conclusions:** Evidence on medical uses of cannabis is broad. However, due to methodological limitations, conclusions were weak in most of the assessed comparisons. Evidence mapping methodology is useful to perform an overview of available research, since it is possible to systematically describe the extent and distribution of evidence, and to organize scattered data.

**KEYWORDS:** Cannabinoids; Cannabis; Evidence mapping; Evidence synthesis; Medical marijuana.

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## Cow's milk substitutes for children: Nutritional aspects of milk from different mammalian species, special formula and plant-based beverages

Elvira Verduci [OrcID] , Sofia D'Elios, Lucia Cerrato, Pasquale Comberati [OrcID] , Mauro Calvani, Samuele Palazzo, Alberto Martelli, *Nutrients*. 2019 Aug; 11(8): 1739.

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Full paper Accessed at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6723250/>.

### ABSTRACT

Cow's milk and dairy are commonly consumed foods in the human diet and contribute to maintaining a healthy nutritional state, providing unique sources of energy, calcium, protein, and vitamins, especially during early childhood. Milk formula is usually made from cow's milk and represents the first food introduced into an infant's diet when breastfeeding is either not possible or insufficient to cover nutritional needs. Very recently, increased awareness of cow's milk protein allergy and intolerance, and higher preference to vegan dietary habits have influenced parents towards frequently choosing cows' milk substitutes for children, comprising other mammalian milk types and plant-based milk beverages. However, many of these milk alternatives do not necessarily address the nutritional requirements of infants and children. There is a strong need to promote awareness about qualitative and quantitative nutritional compositions of different milk formulas, in order to guide parents and medical providers selecting the best option for children. In this article, we sought to review the different compositions in terms of macronutrients and micronutrients of milk from different mammalian species, including special milk formulas indicated for cow's milk allergy, and of plant-based milk alternatives.

**Keywords:** Allergy, children, cow's milk allergy, goat's milk, non-dairy milk, plant-based beverages, plant-based milk, milk formula, nutrition.

## Production-related contaminants (pesticides, antibiotics and hormones) in organic and conventionally produced milk samples sold in the USA

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Volume 22, Issue 16 November 2019 , pp. 2972-2980.

### ABSTRACT

**Objective:** Consumption of cow's milk, which is associated with diet and health benefits, has decreased in the USA. The simultaneous increase in demand for more costly organic milk suggests consumer concern about exposure to production-related contaminants may be contributing to this decline. We sought to determine if contaminant levels differ by the production method used. **Design:** Half-gallon containers of organic and conventional milk (four each) were collected by volunteers in each of nine US regions and shipped on ice for analysis. Pesticide, antibiotic and hormone (bovine growth hormone (bGH), bGH-associated insulin-like growth factor 1 (IGF-1)) residues were measured using liquid or gas chromatography coupled to mass or tandem mass spectrometry. Levels were compared against established federal limits and by production method. **Setting:** Laboratory analysis of retail milk samples. **Results:** Current-use pesticides (5/15 tested) and antibiotics (5/13 tested) were detected in several conventional (26–60 %; n 35) but not in organic (n 34) samples. Among the conventional samples, residue levels exceeded federal limits for amoxicillin in one sample (3 %) and in multiple samples for sulfamethazine (37 %) and sulfathiazole (26 %). Median bGH and IGF-1 concentrations in conventional milk were 9.8 and 3.5 ng/ml, respectively, twenty and three times that in organic samples ( $P < 0.0001$ ). **Conclusions:** Current-use antibiotics and pesticides were undetectable in organic but prevalent in conventionally produced milk samples, with multiple samples exceeding federal limits. Higher bGH and IGF-1 levels in conventional milk suggest the presence of synthetic growth hormone. Further research is needed to understand the impact of these differences, if any, on consumers.

## Vaping-associated respiratory distress syndrome: Case classification and clinical guidance

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*Critical Care Explorations*, February 2020 - Volume 2 - Issue 2 - p e0081  
doi:[10.1097/CCE.0000000000000081](https://doi.org/10.1097/CCE.0000000000000081).

### ABSTRACT

**Objectives:** Exposure to vaping is associated with a growing list of respiratory syndromes including an acute progressive form with life-threatening hypoxemic respiratory failure and pathologic changes of lung injury termed vaping-associated respiratory distress syndrome. **Data Sources:** Center from Disease Control, Departments of Public Health, MEDLINE (via PubMed), and the Cochrane Library. **Study Selection, Data Extraction and Data Synthesis:** Cases, series, and public health reports of cases that met the Centers for Disease Control and Prevention case definition of vaping-associated respiratory disease were extracted by an author with perfect verification by a second. Cases were classified on the basis of toxin exposure, symptoms, oxygen saturation, progression to respiratory failure, and pathologic features, and a clinically actionable system of classification was based on expert opinion. **Conclusions:** The reported spectrum of vaping-associated respiratory diseases allows clinical classification of cases into groups with distinct evaluation, management, and recommendations for prevention and follow-up. Clinical stratification also identifies a small proportion of vaping-exposed patients who are at risk for progression to hypoxemic respiratory failure and an acute respiratory distress syndrome—like

## Re-examination of dairy as a single commodity in US dietary guidance

Elizabeth T Jacobs, Janet A Foote, Lindsay N Kohler, Meghan B Skiba, Cynthia A Thomson  
*Nutrition Reviews*, Volume 78, Issue 3, March 2020, Pages 225—234, <https://doi.org/10.1093/nutrit/nuz093>  
Published February 7, 2020.

### ABSTRACT

Dairy products have been a key component of dietary guidance in the United States for more than 100 years. In light of major advances in the understanding of dietary intake and metabolism, the aim of this review was to examine whether dairy should remain a single commodity in federal guidance. Considerations include recognizing that a substantial proportion of the world's adult population (65%—70%) exhibits lactase nonpersistence, a reduced ability to metabolize lactose to glucose and galactose. Shifts in the US population, including a greater proportion of African Americans and Asians, are of key importance because several studies have shown a markedly higher prevalence of lactase nonpersistence and, consequently, a lower dairy intake among these groups. While cow's milk alternatives are available, families who use them will pay up to an additional \$1,400 per year compared with those who are able to consume dairy products. Dietary guidance also contains downstream effects for government assistance, such as the US Department of Agriculture's National School Lunch Program and School Breakfast Program. For reasons like these, Canada has recently removed dairy as a separate food group in national dietary guidance. The results of the present review suggest that consideration of this modification when developing population-level guidelines in the United States is warranted.

**KEYWORDS:** Dairy, dietary guidelines for Americans, food guidance, milk, RDA.

## Altered gut microbiota is present in newly diagnosed pediatric patients with inflammatory bowel disease

Sila S, Jeli M, Trivi I, Tambi Andraševi A, Hojsak I and Kolaek S  
*J Pediatr Gastroenterol Nutr.* 2020 Apr;70(4):497-502. doi:[10.1097/MPG.0000000000002611](https://doi.org/10.1097/MPG.0000000000002611).

### ABSTRACT

**BACKGROUND AND AIMS:** Clinical and experimental data suggest that gut microbiota plays an important role in the pathogenesis of inflammatory bowel disease (IBD). The aim of this study was to determine intestinal microbiota in newly diagnosed patients with IBD and to compare it with patients' healthy siblings who share same genetic and environmental background and to healthy unrelated controls. **METHODS:** Molecular approach targeting 16S ribosomal RNA was employed for analyzing the gut microbiota of participants' stool samples. Terminal restriction fragment length polymorphism analysis was performed. **RESULTS:** Newly diagnosed pediatric patients with IBD (n=19, 68.4% Crohn disease [CD], mean age 14.8±0.65 years), their unaffected healthy siblings (n=20, mean age 12.8±0.85 years), and unrelated healthy controls (n=19, mean age 10.7±0.8 years) were included. Microbial diversity differed significantly between IBD patients, healthy siblings, and healthy controls (P=0.018 for MspI digestion, P=0.013 for HhaI digestion). No significant difference in microbial diversity was found between healthy siblings and healthy controls. In patients reduced presence of genus Eubacterium, Lactobacillus, Enterobacter and Clostridium, and increased presence of genus Streptococcus, Prevotella and Escherichia, compared with healthy siblings and healthy controls, was found. **CONCLUSION:** Newly diagnosed pediatric patients with IBD show significantly less diverse microbiota and microbial composition compared with healthy siblings and healthy controls.

## Acupuncture or acupressure for pain management during labour

Smith CA, Collins CT, Levett KM, Armour M, Dahlen HG, Tan AL, Mesgarpour B.

Cochrane Database Syst Rev. 2020 Feb 7;2:CD009232. doi:[10.1002/14651858.CD009232.pub2](https://doi.org/10.1002/14651858.CD009232.pub2).

Update of *Acupuncture or acupressure for pain management in labour*. [Cochrane Database Syst Rev. 2011]

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### ABSTRACT

**BACKGROUND:** Many women would like to avoid pharmacological or invasive methods of pain management in labour and this may contribute towards the popularity of complementary methods of pain management. This review examined evidence about the use of acupuncture and acupressure for pain management in labour. This is an update of a review last published in 2011. **OBJECTIVES:** To examine the effects of acupuncture and acupressure for pain management in labour. **SEARCH METHODS:** For this update, we searched Cochrane Pregnancy and Childbirth's Trials Register, (25 February 2019), the Cochrane Central Register of Controlled Trials (the Cochrane Library 2019, Issue 1), MEDLINE (1966 to February 2019), CINAHL (1980 to February 2019), ClinicalTrials.gov (February 2019), the WHO International Clinical Trials Registry Platform (ICTRP) (February 2019) and reference lists of included studies. **SELECTION CRITERIA:** Published and unpublished randomised controlled trials (RCTs) comparing acupuncture or acupressure with placebo, no treatment or other non-pharmacological forms of pain management in labour. We included all women whether nulliparous or multiparous, and in spontaneous or induced labour. We included studies reported in abstract form if there was sufficient information to permit assessment of risk of bias. Trials using a cluster-RCT design were eligible for inclusion, but quasi-RCTs or cross-over studies were not. **DATA COLLECTION AND ANALYSIS:** Two review authors independently assessed trials for inclusion and risk of bias, extracted data and checked them for accuracy. We assessed the certainty of the evidence using the GRADE approach. **MAIN RESULTS:** We included 28 trials with data reporting on 3960 women. Thirteen trials reported on acupuncture and 15 trials reported on acupressure. No study was at a low risk of bias on all domains. Pain intensity was generally measured on a visual analogue scale (VAS) of 0 to 10 or 0 to 100 with low scores indicating less pain. Acupuncture versus sham acupuncture Acupuncture may make little or no difference to the intensity of pain felt by women when compared with sham acupuncture (mean difference (MD) -4.42, 95% confidence interval (CI) -12.94 to 4.09, 2 trials, 325 women, low-certainty evidence). Acupuncture may increase satisfaction with pain relief compared to sham acupuncture (risk ratio (RR) 2.38, 95% CI 1.78 to 3.19, 1 trial, 150 women, moderate-certainty evidence), and probably reduces the use of pharmacological analgesia (RR 0.75, 95% CI 0.63 to 0.89, 2 trials, 261 women, moderate-certainty evidence). Acupuncture may have no effect on assisted vaginal birth (very low-certainty evidence), and probably little to no effect on caesarean section (low-certainty evidence). Acupuncture compared to usual care We are uncertain if acupuncture reduces pain intensity compared to usual care because the evidence was found to be very low certainty (standardised mean difference (SMD) -1.31, 95% CI -2.14 to -0.49, 4 trials, 495 women, I<sup>2</sup> = 93%). Acupuncture may have little to no effect on satisfaction with pain relief (low-certainty evidence). We are uncertain if acupuncture reduces the use of pharmacological analgesia because the evidence was found to be very low certainty (average RR 0.72, 95% CI 0.60 to 0.85, 6 trials, 1059 women, I<sup>2</sup> = 70%). Acupuncture probably has little to no effect on assisted vaginal birth (low-certainty evidence) or caesarean section (low-certainty evidence). Acupressure compared to no treatment One trial compared acupuncture to no treatment. We are uncertain if acupuncture reduces pain intensity (MD -1.16, 95% CI -1.51 to -0.81, 163 women, very low-certainty evidence), assisted vaginal birth or caesarean section because the evidence was found to be very low certainty. Acupressure compared to sterile water injection We are uncertain if acupressure has any effect on use of pharmacological analgesia, assisted vaginal birth or caesarean section because the evidence was found to be very low certainty. Acupressure compared to a sham control We are uncertain if acupressure reduces pain intensity in labour (MD -1.93, 95% CI -3.31 to -0.55, 6 trials, 472 women) or assisted vaginal birth because the evidence was found to be very low certainty. Acupressure may have little to no effect on use of pharmacological analgesia (low-certainty evidence). Acupressure probably reduces the caesarean section rate (RR 0.44, 95% CI 0.27 to 0.71, 4 trials, 313 women, moderate-certainty evidence). Acupressure compared to usual care We are uncertain if acupressure reduces pain intensity in labour (SMD -1.07, 95% CI -1.45 to -0.69, 8 trials, 620 women) or increases satisfaction with pain relief (MD 1.05, 95% CI 0.75 to 1.35, 1 trial, 105 women) because the evidence was found to be very low certainty. Acupressure may have little to no effect on caesarean section (low-certainty evidence). Acupressure compared to a combined control Acupressure probably slightly reduces the intensity of pain during labour compared with the combined control (measured on a scale of 0 to 10 with low scores indicating less pain) (SMD -0.42, 95% CI -0.65 to -0.18, 2 trials, 322 women, moderate-certainty evidence). We are uncertain if acupressure has any effect on the use of pharmacological analgesia (RR 0.94, 95% CI 0.71 to 1.25, 1 trial, 212 women), satisfaction with childbirth, assisted vaginal birth or caesarean section because the certainty of the evidence was all very low. No studies were found that reported on sense of control in labour and only one reported on satisfaction with the childbirth experience. **AUTHORS' CONCLUSIONS:** Acupuncture in comparison to sham acupuncture may increase satisfaction with pain management and reduce use of pharmacological analgesia. Acupressure in comparison to a combined control and usual care may reduce pain intensity. However, for other comparisons of acupuncture and acupressure, we are uncertain about the effects on pain intensity and satisfaction with pain relief due to very low-certainty evidence. Acupuncture may have little to no effect on the rates of caesarean or assisted vaginal birth. Acupressure probably reduces the need for caesarean section in comparison to a sham control. There is a need for further high-quality research that include sham controls and comparisons to usual care and report on the outcomes of sense of control in labour, satisfaction with the childbirth experience or satisfaction with pain relief.

## Trends in diet quality among youth in the United States, 1999-2016

Liu J, Rehm CD, Onopa J, Mozaffarian D.

JAMA. 2020 Mar 24;323(12):1161-1174. doi:[10.1001/jama.2020.0878](https://doi.org/10.1001/jama.2020.0878).

PMID:32207798 PMCID:PMC7093765 [Available on 2020-09-24].

### ABSTRACT

**IMPORTANCE:** Prior studies of dietary trends among US youth have evaluated major macronutrients or only a few foods or have used older data. **OBJECTIVE:** To characterize trends in diet quality among US youth. **DESIGN, SETTING, AND PARTICIPANTS:** Serial cross-sectional investigation using 24-hour dietary recalls from youth aged 2 to 19 years from 9 National Health and Nutrition Examination Survey (NHANES) cycles (1999-2016). **EXPOSURES:** Calendar year and population sociodemographic characteristics. **MAIN OUTCOMES AND MEASURES:** The primary outcomes were the survey-weighted, energy-adjusted mean consumption of dietary components and proportion meeting targets of the American Heart Association (AHA) 2020 continuous diet score (range, 0-50; based on total fruits and vegetables, whole grains, fish and shellfish, sugar-sweetened beverages, and sodium). Additional outcomes were the AHA secondary score (range, 0-80; adding nuts, seeds, and legumes; processed meat; and saturated fat) and Healthy Eating Index (HEI) 2015 score (range, 0-100). Poor diet was defined as less than 40% adherence (scores, <20 for primary and <32 for secondary AHA scores); intermediate as 40% to 79.9% adherence (scores, 20-39.9 and 32-63.9, respectively); and ideal, as at least 80% adherence (scores, ≥40 and ≥64, respectively). Higher diet scores indicate better diet quality; a minimal clinically important difference has not been quantified. **RESULTS:** Of 31 420 youth aged 2 to 19 years included, the mean age was 10.6 years; 49.1% were female. From 1999 to 2016, the estimated AHA primary diet score significantly increased from 14.8 (95% CI, 14.1-15.4) to 18.8 (95% CI, 18.1-19.6) (27.0% improvement), the estimated AHA secondary diet score from 29.2 (95% CI, 28.1-30.4) to 33.0 (95% CI, 32.0-33.9) (13.0% improvement), and the estimated HEI-2015 score from 44.6 (95% CI, 43.5-45.8) to 49.6 (95% CI, 48.5-50.8) (11.2% improvement) ( $P < .001$  for trend for each). Based on the AHA primary diet score, the estimated proportion of youth with poor diets significantly declined from 76.8% (95% CI, 72.9%-80.2%) to 56.1% (95% CI, 51.4%-60.7%) and with intermediate diets significantly increased from 23.2% (95% CI, 19.8%-26.9%) to 43.7% (95% CI, 39.1%-48.3%) ( $P < .001$  for trend for each). The estimated proportion meeting ideal quality significantly increased but remained low, from 0.07% (95% CI, 0.01%-0.49%) to 0.25% (95% CI, 0.10%-0.62%) ( $P = .03$  for trend). Persistent dietary variations were identified across multiple sociodemographic groups. The estimated proportion of youth with a poor diet in 2015-2016 was 39.8% (95% CI, 35.1%-44.5%) for ages 2 to 5 years (unweighted  $n = 666$ ), 52.5% (95% CI, 46.4%-58.5%) for ages 6 to 11 years (unweighted  $n = 1040$ ), and 66.6% (95% CI, 61.4%-71.4%) for ages 12 to 19 years (unweighted  $n = 1195$ ), with persistent differences across levels of parental education, household income, and household food security status. **CONCLUSIONS AND RELEVANCE:** Based on serial NHANES surveys from 1999 to 2016, the estimated overall diet quality of US youth showed modest improvement, but more than half of youth still had poor-quality diets.

## What is the effect of spinal manipulation on the pressure pain threshold in young, asymptomatic subjects? A randomized placebo-controlled trial, with a cross-over design

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### ABSTRACT

**BACKGROUND:** Spinal manipulation (SM) has been shown to have an effect on the pressure pain threshold (PPT) in asymptomatic subjects, but SM has never been compared in studies on this topic to a validated sham procedure. We investigated the effect of SM on the PPT when measured i) in the area of intervention and ii) in an area remote from the intervention. In addition, we measured the size and duration of the effect. **METHOD:** In a randomized cross-over trial, 50 asymptomatic chiropractic students had their PPT measured at baseline, immediately after and every 12 min after intervention, over a period of 45 min, comparing values after SM and a previously validated sham. The trial was conducted during two sessions, separated by 48h. PPT was measured both regionally and remotely from the 'treated' thoracic segment. Blinding of study subjects was tested with a post-intervention questionnaire. We used mixed linear regression with the baseline value and time as co-variables. If a significant difference were found between groups, then an effect size would be calculated using Cohen's  $d$  or Hedge's  $h$  coefficient. Statistical significance was set at  $p < 0.05$ . **RESULTS:** Study subjects had been successfully blinded. No statistically significant differences were found between SM and sham estimates, at any time or anatomical location. **CONCLUSION:** When compared to a valid sham procedure and with successfully blinded subjects, there is no regional or remote effect of spinal manipulation of the thoracic spine on the pressure pain threshold in a young pain-free population.

**KEYWORDS:** Asymptomatic subjects; Duration; Effect; Effect size; Pressure pain threshold; Randomized controlled trial; Sham; Spinal manipulation.

## Mental health status among children in home confinement during the coronavirus disease 2019 outbreak in Hubei Province, China

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### ABSTRACT

As the coronavirus disease 2019 (COVID-19) epidemic progressed in Wuhan, Hubei province, China, the Chinese government ordered a nationwide school closure. More than 180 million students in China were restricted to their homes (<http://www.chinanews.com/sh/2020/02-17/9094648.shtml>). The COVID-19 infection has become a global pandemic. As of April 9, 2020, the infection has caused 188 countrywide closures around the world and has affected 1,576,021,818 learners (<https://zh.unesco.org/themes/education-emergencies/coronavirus-school-closures>). The caution about protecting the mental health of children in home confinement is warranted. This study investigated depressive and anxiety symptoms among students in Hubei province, China, which can help optimize interventions on the mental health of children for stakeholders in all countries affected by COVID-19.

## Characteristics and outcomes of children with coronavirus disease 2019 (COVID-19) infection admitted to US and Canadian pediatric intensive care units

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### ABSTRACT

**Importance:** The recent and ongoing coronavirus disease 2019 (COVID-19) pandemic has taken an unprecedented toll on adults critically ill with COVID-19 infection. While there is evidence that the burden of COVID-19 infection in hospitalized children is lesser than in their adult counterparts, to date, there are only limited reports describing COVID-19 in pediatric intensive care units (PICUs). **Objective:** To provide an early description and characterization of COVID-19 infection in North American PICUs, focusing on mode of presentation, presence of comorbidities, severity of disease, therapeutic interventions, clinical trajectory, and early outcomes. **Design, Setting, and Participants:** This cross-sectional study included children positive for COVID-19 admitted to 46 North American PICUs between March 14 and April 3, 2020, with follow-up to April 10, 2020. **Main Outcomes and Measures:** Prehospital characteristics, clinical trajectory, and hospital outcomes of children admitted to PICUs with confirmed COVID-19 infection. **Results:** Of the 48 children with COVID-19 admitted to participating PICUs, 25 (52%) were male, and the median (range) age was 13 (4.2-16.6) years. Forty patients (83%) had significant preexisting comorbidities; 35 (73%) presented with respiratory symptoms and 18 (38%) required invasive ventilation. Eleven patients (23%) had failure of 2 or more organ systems. Extracorporeal membrane oxygenation was required for 1 patient (2%). Targeted therapies were used in 28 patients (61%), with hydroxychloroquine being the most commonly used agent either alone (11 patients) or in combination (10 patients). At the completion of the follow-up period, 2 patients (4%) had died and 15 (31%) were still hospitalized, with 3 still requiring ventilatory support and 1 receiving extracorporeal membrane oxygenation. The median (range) PICU and hospital lengths of stay for those who had been discharged were 5 (3-9) days and 7 (4-13) days, respectively. **Conclusions and Relevance:** This early report describes the burden of COVID-19 infection in North American PICUs and confirms that severe illness in children is significant but far less frequent than in adults. Prehospital comorbidities appear to be an important factor in children. These preliminary observations provide an important platform for larger and more extensive studies of children with COVID-19 infection.