Complementary Therapies in Medicine 43 (2019) 196–200

Contents lists available at ScienceDirect

Complementary Therapies in Medicine

journal homepage: www.elsevier.com/locate/ctim

Pediatric natural health products recommended by chiropractic and naturopathic doctors in Canada

Antony Joseph Porcino[a], Leslie Solomonian[b], Stephen Zylich[c], Chantal Doucet[d], Brian Gluvic[e], Sunita Vohra[a,*]

[a] CARE Program, Department of Pediatrics, Faculty of Medicine & Dentistry, University of Alberta, Canada
[b] Canadian College of Naturopathic Medicine, Toronto, Canada
[c] Canadian Memorial Chiropractic College, Toronto, Canada
[d] Département de Chiropratique, Université du Québec à Trois-Rivières, Trois-Rivières, Canada
[e] Boucher Institute of Naturopathic Medicine, New Westminster, Canada

ARTICLE INFO

Keywords:
Pediatrics
Integrative medicine
Complementary medicine
Survey
Naturopathy
Chiropractic
Natural health products

ABSTRACT

Objectives: To assess chiropractic (DC) and naturopathic doctors' (ND) pediatric care natural health product (NHP) recommendations.

Design: Surveys were developed in collaboration with DC and ND educators, and delivered as an on-line national survey. NHP dose, form of delivery, and indications across pediatric age ranges (from newborn to 16 years) for each practitioner's top five NHPs were assessed. Data were analyzed using descriptive statistics, t-tests, and non-parametric tests.

Results: Of the 421 respondents seeing one or more pediatric patients per week, 172 (41%, 107 DCs, 65 NDs) provided 440 NHP recommendations, categorized as: *vitamins and minerals* (89 practitioners, 127 recommendations), *probiotics* (110 practitioners, 110 recommendations), *essential fatty acids* (EFAs: 72 practitioners, 72 recommendations), *homeopathics* (56 practitioners, 66 recommendations), *botanicals* (29 practitioners, 31 recommendations), and *other NHPs* (33 practitioners, 34 recommendations). Indications for the NHP recommendations were tabulated for NHPs with 10 or more recommendations in any age category: 596 total indications for probiotics, 318 indications for essential fatty acids, 138 indications for vitamin D, and 71 indications for multi-vitamins.

Conclusions: This is the first study documenting the pediatric NHP recommendations of two popular complementary medicine professions. Common NHPs at standard doses are the most frequently recommended products, with use and doses adjusted according to age. High-quality evidence regarding the efficacy, safety, and dosing for NHP use in children is scarce; development of evidence-informed pediatric guidelines is recommended, particularly for the most commonly used and recommended NHPs.

1. Introduction

Pediatric use of complementary therapies, documented in at least 160 studies, includes a broad variety of modalities. Pediatric use of complementary therapies, documented in at least 160 studies, includes a broad variety of modalities.[1,2] The most commonly used are natural health products (NHPs), spinal manipulation, massage, and acupuncture.[1,2] Most of these studies describe patient-reported use, typically assessed through surveys deployed at conventional medical settings. Many of the therapies described in those surveys include commercially available NHPs, such as vitamins, minerals, and commonly available herbal preparations and homeopathic remedies. These studies suggest significant pediatric NHP use, almost half of children generally[3,4] and up to 80% in children with chronic conditions.[4–8] Pediatric use of NHPs is of particular interest because of the potential differences in pharmacokinetics between children and adults, and most of the evidence and safety information on complementary therapies is based on adult studies.

Several studies have reported that parents primarily choose NHPs without the advice of a health care provider, using instead information

Abbreviations: CNS, central nervous system; DC, Chiropractic doctor; EFAs, essential fatty acids; ND, Naturopathic doctor; NHP, Natural health product

* Corresponding author at: CARE Program, Department of Pediatrics, Faculty of Medicine & Dentistry, University of Alberta, Suite #1702, College Plaza 8215 112 St NW, Edmonton, AB, T6G 2C8, Canada.
E-mail address: care@med.ualberta.ca (S. Vohra).

https://doi.org/10.1016/j.ctim.2019.02.001
Received 12 November 2018; Received in revised form 31 January 2019; Accepted 1 February 2019
Available online 04 February 2019
0965-2299/

about the products gleaned from various media sources or family and friends.[9–11] Chiropractic (DC) and Naturopathic doctor (ND) NHP recommendations for pediatric patients have not been described, even though many DCs and NDs provide care to children.[2,9,12]

We therefore assessed the most frequently recommended NHPs of Canadian DCs and NDs for children in their practice to explore common pediatric NHP clinical recommendation patterns and the potential safety concerns for the commonly recommended NHPs.

2. Methods

2.1. Survey development

As described in detail elsewhere,[12] the survey was developed by experienced survey researchers in collaboration with DC and ND educators using standard survey methodology, based on the relevant literature. DCs and NDs were surveyed in both 2004 and 2014; the 2004 survey information on NHP use was minimal and not comparable to the comprehensive 2014 data described here. In the 2014 survey, both ND and DC participants were invited to name up to five of their most commonly used NHPs, and describe dose, form of delivery, and indications across pediatric age ranges (from newborn to 16 years).

2.2. Participant recruitment

We used an online survey system. To maximize response rate, Canadian DCs and NDs were sent emails with a link to the questionnaire from participating provincial (DC) and national associations (ND), provincial regulatory bodies (DC and ND), or educational colleges (DC and ND). All surveys were deployed using accepted methodology for e-surveys.[13] Criteria for respondent eligibility were: 1) provided informed consent (participated in the survey), and 2) saw children less than 16 years of age in their practice.

2.3. Analysis

The primary analysis is descriptive (frequencies, percentage). Chi-square and z-test for population proportions are used for comparing answers between groups. All comparisons are two-tailed and considered statistically significant at $p < 0.05$. Respondents did not answer all questions; results are based on all available data.

Text responses were quantized[14] using a summative content analysis approach.[15] One author (AP) did the initial coding and category development; a second author (LS) reviewed the results; all discrepancies were discussed until consensus was achieved. Refinement and collapsing of categories was reviewed by all authors, with discrepancies resolved through discussion until consensus was achieved. At least 10 responses identifying an NHP or indication were deemed necessary for recognizing a final category or undertaking descriptive analysis.

Many responses were incomplete. For a case (i.e., a mentioned use of a specific NHP by a practitioner) to be included in analyses, it had to specify the NHP name and indicate use in at least one of the five age categories. The quantizing process and calculations used all available data.

The survey received ethical approval from the University of Alberta Human Research Ethics Board.

3. Results

553 DCs (15.5%) and 162 NDs (36%) responded to the survey. Of the 449 respondents seeing one or more pediatric patients per week, 172 (41%, 107 DCs, 78%, 65 NDs) responded to questions regarding NHP recommendations. There was no significant difference in age ($t = 0.662$, 434df, $p = 0.51$), years of experience ($t = 1.197$, 435df, $p = 0.23$), location of business ($X^2 = 4.50$, 4df, $p = 0.34$), degree of undergraduate education ($z = 1.916$, $p = 0.06$), post-graduate pediatric education ($z = -0.632$, $p = 0.53$), comfort in treating pediatric patients ($X^2 = 0.03$, 4df, $p = 0.99$), and number of patients per week ($t = 1.897$, 434df, $p = 0.07$) between the practitioners seeing pediatric patients who answered questions on NHP use, and those who did not (data not shown). Fifteen survey cases, providing only the name of an NHP with no other information, were removed. Twice as many NDs (68%) relative to DCs (34%) recommended NHPs in their practice ($z = 8.3$, $p < .001$).

3.1. NHP use recommendations

Responding practitioners provided 440 pediatric NHP recommendations clustered into six main types: *vitamins and minerals (29%), probiotics (25%), essential fatty acids (EFAs, 16%), homeopathics (15%), botanicals (8%),* and *other NHPs (7%)*. A chi-squared comparison of ND to DC use for these categories showed no statistical difference between the professions ($X^2 = 5.79$, 5 df, $p = 0.327$, data not shown), so combined profession data is used. Each NHP type is described more fully below, including forms of delivery.

3.1.1. Vitamins & minerals

Eighty-nine practitioners indicated 127 vitamin and mineral recommendations, including commercial preparations sold as multivitamins. Amongst the vitamins and minerals, Vitamin D was the most commonly recommended NHP (n = 46), with few others mentioned more than twice (Fig. 1). Individual minerals recommended were calcium, iron, magnesium, potassium, and zinc; "other vitamins/minerals" were unspecified or practitioner-specified combinations. Primary delivery forms were tablets, capsules, powders, and liquids.

3.1.2. Probiotics

110 practitioners indicated recommending probiotics. The generic term probiotic was used by all respondents except two who specified *Acidophilus*. The most common delivery forms were liquids/drops, powders, and capsules.

3.1.3. Essential fatty acids (EFAs)

72 practitioners indicated recommending EFAs. These were primarily listed as "fish oil" and "omega three fatty acids" (n = 61), though EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) were sometimes listed. Common delivery forms were liquids and capsules.

3.1.4. Homeopathics

56 practitioners indicated 66 homeopathic recommendations, with few specific remedy names except one brand of topical ointment for

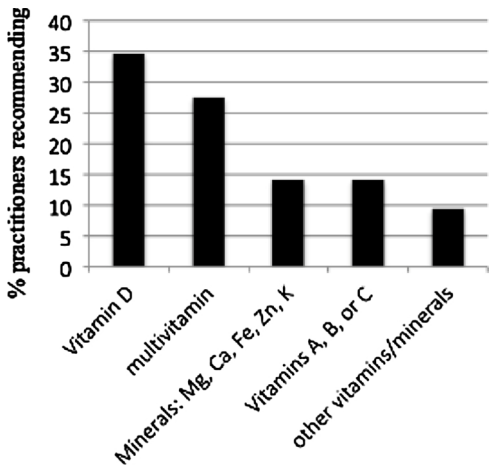

Fig. 1. Vitamin & Mineral recommendations by practitioners (n = 127).

abrasions with 12 mentions. Homeopathics were predominantly recommended as pellets (a common delivery form, usually lactose-based), liquids, and topical creams or salves.

3.1.5. Botanicals

33 practitioners indicated 34 botanical NHP recommendations. This category includes all substances prepared from plants, and can comprise powdered whole forms as well as extracts. Botanicals may be single herb preparations, such as calendula cream, tea tree oil, or elderberry tincture, or mixtures. Specific botanicals were rarely mentioned; castor oil (*Ricinus communis*; n = 4), arnica (*Arnica montana*; n = 3) and elderberry (*Sambucus nigra*; n = 3) had the most recommendations. The delivery forms varied widely: external applications included packs, compresses and poultices, creams and salves, topical oils, sprays, and baths; internal delivery included inhalation, sprays, infusions, and ingested tinctures, oils, tablets, and capsules.

3.1.6. Other NHPs

29 practitioners indicated 31 recommendations for NHPs not included in the above categories. Individual NHPs (n = 9) included 5HTP (5-hydroxytryptophan), enzymes, colostrum, glucosamine, glutamine, and lysine. This category also includes cross-category commercial blends (n = 4), and unspecified practitioner blends and NHP lists provided as a single answer (n = 18). Delivery forms were capsules and tablets.

3.2. NHP recommendation indications and dosing

Table 1 summarizes the data for the specific NHPs with n ≥ 10 recommendations in at least one age category: probiotics, essential fatty acids, Vitamin D, and multivitamins. It provides basic information about the number of practitioners recommending the NHP in each age category, the primary indications provided by practitioners for each NHP, and a column providing a summary of current review papers that include pediatric populations regarding the general safety of the NHP.

The practitioners' dosing ranges for each age category are also provided for each NHP in Table 1. While the survey requested dosing information, there was no consistency in dosing reporting or inclusion of concentration values. Thus, most quantity indicators (e.g., ¼ tsp, 2 drops, as per bottle instructions) provided no indication of the effective dose. Dosing is likely related to the indication(s) for use, but there was not enough data to assess for relationships between dosing and indications.

Aside from probiotics, recommendations for NHP use in newborns and infants is lower than for the older patients. The above indications were the primary uses for the most commonly mentioned NHPs; there are not enough data to assess relationships between the other NHPs and reported indications, or to test for relationships between different delivery forms or dosing of NHPs and indications.

4. Discussion

To our knowledge, we present the first summary of pediatric NHP recommendations by DCs and NDs who see one or more pediatric patients per week. There are few general pediatric population surveys of complementary medicine use concurrent with this survey (2014) for comparison, and fewer identify the individual NHPs. Table 2 presents data from one provincial survey of pediatric NHP use (2007–2009, Godwin),[3] the USA National Health Interview Survey (all ages, NHIS),[9] and the North American most frequently purchased supplements (all ages, TABS) in 2014.[26] While the proportions show clear differences (discussed further below), all top NHPs in each survey match our top NHPs, suggesting that the most common NHPs used by the public also comprise the most frequently recommended NHPs by responding practitioners. Surveys of complementary medicine use in specific condition populations often show higher levels of use.[5–7]

The USA NHIS survey does not include vitamin and mineral data, but their top three non-vitamin/mineral supplements match our survey's top three results. The Godwin data is from five to seven years earlier than our survey, and the NHIS two years previous. In that time, evidence has accumulated that vitamin and mineral supplementation generally is not needed except in certain situations.[27]

Similarly, since 2009, rigorous EFA evidence has been increasing[9,28] along with interest in probiotic/intestinal biome research.[29] The TABS data suggest that public EFA and probiotics use were catching up with professional recommendations in 2014. Patterns of NHP use by the public change slowly regardless of the current available evidence.[30] With no prior published information on practitioner recommendations, we do not know how practitioner recommendation patterns are affected by emerging evidence or the impact of other clinical practice considerations such as dietary sources of vitamins and minerals.

Like most surveys of health care professionals, the primary limitation of our work is the relatively low response rate. We attribute this to the high level of burden posed by this series of questions (to identify their most commonly recommended NHPs and for each, to describe the delivery form, dose(s), and indication(s) for all five pediatric age categories). While we note that there is no statistical difference between respondents who did and did not provide NHP data, we are cautious about generalizing NHP recommendation results.

Even given the limitation, the results present two factors that deserve further consideration: age-related dose adjustments, and the prevalence of commonly purchased NHPs in the top NHP recommendations. Our results show practitioners adjust dose or use of NHPs according to age. Pharmacokinetic knowledge of pharmaceuticals in children suggests that different ages may metabolize compounds differently and that doses need to be age- and/or mass-adjusted and the prevalence of commonly purchased NHPs in the top NHP recommendations. Our results show practitioners adjust dose or use of NHPs according to age[31,32] While NHPs may also need such adjustment—for example the recommended daily allowance for vitamin D is lower for newborns[33]—generally there are a lack of data to inform this practice; development of evidence-informed guidelines is recommended for the most commonly used NHPs in children. There were few examples of unusual NHPs, uses, or doses reported in our survey (practitioner-adjusted doses all lying within Health Canada recommended dosing ranges), with the top NHP recommendations matching those commonly purchased off the shelf.

4.1. Future directions and conclusions

It would be useful to develop evidence regarding each of the indications for the NHP recommendations including pediatric dosing, particularly for those NHPs more commonly recommended or that have higher-risk profiles. With the current pediatric dosing and safety information gaps, we suggest that educational institutions and practitioner organizations regularly update their education and knowledge transference information containing evidence-based information for pediatric NHP use, harms and harms reporting, and dosing. This recommendation is in line with our findings that practitioners desire more education regarding pediatric use of complementary therapies.[12] Follow-up research to assess the effectiveness of the education and information distribution would be warranted, as well as similar research in other populations to assess similarities and trends in professional NHP recommendations. Qualitative interviews with practitioners may help identify key points for monitoring NHP recommendation trends, and educational and evidence-access opportunities.

Our results provide the first documented pediatric NHP recommendations data of complementary medicine professionals that can be used to assess the future impact of education and evidence on NHP recommendation patterns. The lack of pediatric dosing information and often still-inconclusive evidence presents difficulties for evidence-informed NHP recommendations, the difficulties including the need to

Table 1
Top NHPs and their indication categories.

NHP		Newborn	infant	preschool n (%)	school-aged	adolescent	Total	Safety
Probiotics	Recommended by 110 (64%) of practitioners							generally considered as safe[16–18]
	Recommendations by age category, n (%)	84 (77)	99 (91)	106 (97)	108 (99)	109 (99)		
	Dose range [a] (colony forming units, cfu) (m = million, b = billion)	2 m to 8b	2 m to 10b	3m to 20b	10 m to 20b	2b to 60b		
	Practitioners gave indications, n (%)	68 (62)	74 (67)	71 (65)	72 (65)	69 (63)		
	Combined Indications (n)	111	127	118	125	115	596	
	GI support [b] n (%)	64 (94)	66 (89)	62 (87)	66 (92)	57 (83)	315	
	immune support [c] n (%)	10 (15)	23 (31)	26 (37)	29 (40)	26 (38)	114	
	skin [d] n (%)	10 (15)	19 (26)	14 (20)	12 (17)	10 (14)	65	
	infections [e] n (%)	18 (26)	10 (14)	7 (10)	5 (7)	4 (6)	44	
	other [j] n (%)	9 (13)	9 (12)	9 (13)	13 (18)	16 (23)	56	
EFAs	Recommended by 72 (42%) of practitioners							generally considered as safe up to 5 g/day[19–21]
	Recommendations by age category, n (%)	21 (29)	39 (54)	65 (90)	71 (99)	71 (97)		
	Dosing range [a] (mg)	no data	100 to 1000	30 to 1000	250 to 1500	350 to 2500		
	Practitioners gave indications, n (%)	17 (24)	30 (42)	44 (61)	46 (64)	46 (64)		
	Combined Indications (n)	24	45	76	86	87	318	
	skin [d] n (%)	6 (36)	17 (57)	20 (45)	19 (41)	19 (41)	81	
	brain & CNS [f] n (%)	5 (29)	11 (37)	17 (39)	16 (35)	18 (39)	67	
	immune support [c] n (%)	3 (18)	7 (23)	14 (32)	18 (39)	14 (30)	56	
	behavioral / mood [g] n (%)	0 (0)	0 (0)	5 (11)	12 (26)	12 (26)	29	
	general health [h] n (%)	7 (41)	6 (20)	10 (23)	8 (17)	10 (22)	41	
	other [j] n (%)	3 (18)	4 (13)	10 (23)	13 (29)	14 (30)	44	
Vitamin D	Recommended by 44 (26%) of practitioners							unsafe at on-going high doses (> 40,000IU)[19,22,23]
	Recommendations by age category, n (%)	27 (61)	35 (80)	42 (96)	44 (100)	44 (100)		
	Dosing range [a] (IU)	150 to 1000	150 to 1000	400 to 2000	400 to 5000	800 to 5000		
	RDA (IU)[24]	400	600	600	600	600		
	Combined Indications (n)	18	27	30	32	31	138	
	general health [h] n (%)	13 (81)	15 (68)	16 (67)	16 (64)	15 (60)	75	
	immune support [c] n (%)	5 (31)	11 (50)	13 (54)	14 (56)	14 (56)	57	
	bone health [i] n (%)	0 (0)	1 (5)	1 (4)	2 (1)	2 (1)	6	
Multi-vitamin	Recommended by 35 (18%) of practitioners							generally considered as safe[25]
	Recommendations by age category, n (%)	2 (6)	9 (26)	24 (69)	35 (100)	32 (91)		
	Dosing range [a]	no data	no data	no data	no data	no data		
	Practitioners gave indications, n (%)	4 (12)	4 (12)	12 (35)	18 (53)	17 (50)		
	Combined Indications (n)	7	7	14	21	22	71	
	general health [h] n (%)	3	3	12	17	15	50	
	immune support [c] n (%)	3	3	1	2	2	11	
	other [j] n (%)	1	1	1	2	5	10	

a: dose range is given when there is a relevant, scalar unit of measurement for the type of NHP; **b:** *GI support* includes reflux, thrush, and colonizing gut; **c:** *immune support* includes immune function, allergies, asthma, and inflammation; **d:** *skin* includes skin and eczema care; **e:** *infections* required reference to "infection"; **f:** *brain & CNS* (central nervous system) includes brain and CNS health and development as well as autism spectrum disorders; **g:** *behavioural/mood* includes general descriptions as well as specifics such as anxiety, depression, and ADD-like conditions; **h:** *general health* includes prevention/wellness and dietary supplementation; **i:** *bone health* encompasses references to bones and bone development; **j:** *other* includes indications that did not fit the other categories.

Table 2
Comparison of our top 10 NHPs to current surveys on NHP use.

	This survey (%)	Godwin (%)	TABS (%)	NHIS (%)
Probiotics	24.8	0.6	5.3	0.5
EFAs	16.4	7.2	15.5	1.1
homeopathics	15	7.2	— [a]	1.8
vitamin D	10	14.5	15.0	— [a]
multivitamin	8	61.1	29.9	— [a]
"vitamins" [b]	2	— [a]	— [a]	— [a]
vitamin C	2	4.5	12.8	— [a]
magnesium	2	0	— [a]	— [a]
vitamin B	1	0	10.7	— [a]
Calcium	1	0.6	10.7	— [a]

a: not assessed/reported. b: a generic, undifferentiated category used by some respondents.

dose-adjust using unproven processes and the need for extrapolation and "off-label" recommendations based on the current limited evidence. Even so, there were few examples of unusual NHPs, uses, or doses reported in our survey. In light of common public use and practitioner recommendations for use, evidence-based use, safety, and dosing guidelines for NHP use in children is clearly needed, particularly in relation to the commonly recommended and used NHPs.

Funding

For the 2014 survey and manuscript development, funding was secured from the Senior Investigator's general operating funds. No funder had any role in the design of the study; collection, analysis, or interpretation of the data; or writing this manuscript.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author upon request.

Authors' contributions

AP coordinated the second survey including revisions and execution, carried out the analyses, and drafted and revised the manuscript. LS revised the second survey, reviewed the results, and reviewed the manuscript. SZ revised the second survey, reviewed the results, and reviewed the manuscript. BG revised the second survey, reviewed the results, and reviewed the manuscript. CD reviewed the results and

reviewed the manuscript. SV conceptualized and designed the study, co-developed both surveys, and reviewed the manuscript. All authors approved the final manuscript.

Ethics approval and consent to participate

The surveys received ethical approval from the University of Alberta Human Research Ethics Board, study IDs: 2004: B-180903; 2014: Pro00046876. All surveys included notice that participating in the survey indicated research participation consent.

Consent for publication

Not applicable.

Competing interests

The chiropractic and naturopathic doctors are responsible for pediatric curriculum at their educational institutions: LS at the Canadian College of Naturopathic Medicine, Toronto, Canada; SZ at the Canadian Memorial Chiropractic College, Toronto, Canada; BG at the Boucher Institute of Naturopathic Medicine, New Westminster, Canada; and CD at the Département de Chiropratique, Université de Québec à Trois-Rivières, Trois-Rivières, Canada. There are no other competing interests to declare. The authors have no financial relationships relevant to this article to disclose.

Acknowledgements

During the time of this study, Sunita Vohra received salary support from Alberta Innovates-Health Solutions (formerly Alberta Heritage Foundation for Medical Research) and the Canadian Institutes of Health Research.

References

1. National Center for Health Statistics. *Complementary and Alternative Medicine Use Among Adults and Children: United States.* 2007; 2007:1–24 2008 Dec 4.
2. Surette S, Vohra S. Complementary, holistic, and integrative medicine: utilization surveys of the pediatric literature. *Pediatr Rev.* 2014;35(March(3)) 114–27–quiz128.
3. Godwin M, Crellin J, Mathews M, et al. Use of natural health products in children. *Can Family Phys.* 2013;59:e364–71.
4. Taylor DM, Dhir R, Craig SS, et al. Complementary and alternative medicine use among paediatric emergency department patients. *J Paediatr Child Health.* 2015;51(September(9)):895–900.
5. Adams D, Whidden A, Honkanen M, et al. Complementary and alternative medicine: a survey of its use in pediatric cardiology. *CMAJ Open.* 2014;2(October(4)):E217–24.
6. Adams D, Schiffgen M, Kundu A, et al. Patterns of utilization of complementary and alternative medicine in 2 pediatric gastroenterology clinics. *J Pediatr Gastroenterol Nutr.* 2014;59(September(3)):334–339.
7. Valji R, Adams D, Dagenais S, et al. Complementary and alternative medicine: a survey of its use in pediatric oncology. *Evid Based Complement Alternat Med.* 2013;2013(10):527163–527168.
8. Galicia-Connolly E, Adams D, Bateman J, et al. CAM use in pediatric neurology: an exploration of concurrent use with conventional medicine. Lafrenie R, editor *PLoS One.* 2014;9(4) e94078.
9. Black LI, Clarke TC, Barnes PM, Stussman BJ, Nahin RL. Use of complementary health approaches among children aged 4-17 years in the United States: National Health Interview Survey, 2007-2012. *Natl Health Stat Report.* 2015;10(February(78)):1–19.
10. Bailey RL, Gahche JJ, Thomas PR, Dwyer JT. Why US children use dietary supplements. *Pediatr Res.* 2013;74(December(6)):737–741.
11. Goldman RD, Vohra S, Rogovik AL. Vitamin use among children attending a Canadian pediatric emergency department. *Fundam Clin Pharmacol.* 2011;25(February(1)):131–137.
12. Porcino A, Solomonian L, Zylich S, Gluvic B, Doucet C, Vohra S. Pediatric training and practice of Canadian chiropractic and naturopathic doctors: a 2004-2014 comparative study. *BMC Complement Altern Med.* 2017;1;17(December(1)):512.
13. Woodward C, Chambers LW. *Guide to improved data collection in health and health care surveys.* Toronto: Canadian Public Health Association; 1982.
14. Sandelowski M, Voils CI, Knafl G. On Quantitizing. *J Mix Methods Res.* 2009;1;3(July (3)):208–222 2nd ed.
15. Hsieh H-F, Shannon SE. Three approaches to qualitative content analysis. *Qual Health Res.* 2005;15(November(9)):1277–1288 2nd ed.
16. van den Nieuwboer M, Brummer RJ, et al. Safety of probiotics and synbiotics in children under 18 years of age. *Benef Microbes.* 2015;6(5):615–630.
17. van den Nieuwboer M, et al. Probiotic and synbiotic safety in infants under two years of age. *Benef Microbes.* 2014;5(March(1)):45–60.
18. Hempel S, Newberry S, Ruelaz A, et al. Safety of probiotics used to reduce risk and prevent or treat disease. *Evid Rep Technol Assess (Full Rep).* 2011(April(200)):1–645.
19. Bath-Hextall FJ, Jenkinson C, Humphreys R, Williams HC. Dietary supplements for established atopic eczema. In: Cochrane Skin Grouped. *Cochrane database of systematic reviews (Online).* vol.15. 2012; 2012:225 February(2):CD005205.
20. EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA). Scientific opinion related to the Tolerable Upper Intake Level of eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA) and docosapentaenoic acid (DPA). *EFSA J.* 2012;10(7):2815.
21. HE Bays. Safety considerations with omega-3 fatty acid therapy. *Am J Cardiol.* 2007;19;99(March(6A)):35C–43C.
22. Vogiatzi MG, Jacobson-Dickman E, DeBoer MD. Drugs, and Therapeutics Committee of The Pediatric Endocrine Society. Vitamin D supplementation and risk of toxicity in pediatrics: a review of current literature. *J Clin Endocrinol Metab.* 2014;99(April (4)):1132–1141.
23. Papadimitriou DT. The big Vitamin D mistake. *J Prev Med Public Health.* 2017;50(July (4)):278–281.
24. Institute of Medicine. Ross AC, Taylor CL, Yaktine AL, Del Valle HB, eds. *Dietary referece intakes for calcium and vitamin D.* Washington, DC, USA: The national Academies Press; 2011.
25. Huang H-Y, Caballero B, Chang S, et al. Multivitamin/mineral supplements and prevention of chronic disease. *Evid Rep Technol Assess (Full Rep).* 2006(May (139)):1–117.
26. Analytics T. *TABS Analytics 10th annual vitamins, minerals and supplements study [Internet]. TABS Analytics; 2017 [cited 2018 sep 14].* . Available from: 2017; 2017https://cdn2.hubspot.net/hubfs/544043/2017_Webinars/2017%20VMS/Whitepaper/Vitamins%20and%20Minerals%20Study%202017.pdf.
27. Dietitians of Canada. Vitamins and Minerals FAQs [Internet]. UnlockFood.ca. [cited 2018 Sep 14]. Available from: http://www.unlockfood.ca/en/Articles/Vitamins-and-Minerals/Vitamins-and-Minerals-FAQs.aspx?aliaspath=%2fen%2fArticles%2fNutrients-(vitamins-and-minerals)%2fVitamins-and-Minerals-FAQs.
28. Bloch MH, Qawasmi A. Omega-3 fatty acid supplementation for the treatment of children with attention-deficit/hyperactivity disorder symptomatology: systematic review and meta-analysis. *J Am Acad Child Adolesc Psychiatry.* 2011;50(October (10)):991–1000.
29. Lenfestey MW, Neu J. Probiotics in newborns and children. *Pediatr Clin North Am.* 2017;64(December(6)):1271–1289.
30. Kantor ED, Rehm CD, Du M, White E, Giovannucci EL. Trends in Dietary Supplement Use Among US Adults From 1999-2012. *JAMA.* 2016;11;316(October (14)):1464–1474.
31. Blumer JL. Developmental pharmacology: past, present and future. *Acta Paediatr Jpn.* 1996;38(December(6)):555–561.
32. Elias GP, Antoniali C, Mariano RC. Comparative study of rules employed for calculation of pediatric drug dosage. *J Appl Oral Sci.* 2005;13(June(2)):114–119.
33. Food and Nutrition Board, Committee to Review Dietary Reference Intakes for Vitamin D and Calcium. DRI Dietary Reference Intakes: Calcium Vitamin D [Internet]. Ross AC, Taylor CL, Yaktine AL, Del Valle HB, editors. Washington, DC: The National Academic Press. Available from: https://www.nap.edu/read/13050/chapter/1#ii.