

BMJ Open Effect of diet, exercise and sleep on tic severity: a scoping review protocol

Elaheh Nosratmirshekarlou,¹ Samreen Shafiq,² Zahra S Goodarzi,³ Davide Martino,⁴ Tamara Pringsheim⁵

To cite: Nosratmirshekarlou E, Shafiq S, Goodarzi ZS, *et al*. Effect of diet, exercise and sleep on tic severity: a scoping review protocol. *BMJ Open* 2019;**9**:e024653. doi:10.1136/bmjopen-2018-024653

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2018-024653>).

Received 6 June 2018

Revised 19 February 2019

Accepted 11 June 2019



© Author(s) (or their employer(s)) 2019. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

¹Pediatrics, University of Calgary, Calgary, Alberta, Canada

²Community Health Sciences, University of Calgary, Calgary, Alberta, Canada

³Medicine, University of Calgary, Calgary, Alberta, Canada

⁴Clinical Neurosciences, University of Calgary, Calgary, Alberta, Canada

⁵Clinical Neurosciences, Psychiatry, Pediatrics and Community Health Sciences, University of Calgary, Calgary, Alberta, Canada

Correspondence to

Dr Tamara Pringsheim; tprings@ucalgary.ca

ABSTRACT

Introduction Tourette syndrome is a common childhood-onset neuropsychiatric disorder, with tics that wax and wane in frequency and severity over time. The purpose of the proposed scoping review is to map the types of evidence available pertaining to the effect of diet, sleep and exercise on tic severity and identify key concepts and gaps in research.

Methods Our scoping review will use the six-step framework recommended by Arksey and O'Malley, with enhancements from Levac *et al* and Joanna Briggs Institute. We will attempt to identify all the relevant literature regardless of study design. We will search six electronic databases, the reference lists of all selected studies and the grey literature for studies examining an association between dietary factors, sleep or physical exercise and tics, or studies of interventions targeting diet, sleep or exercise to reduce tics. Our analysis plan includes description of the reported associations among dietary factors, sleep and physical exercise and tics, the effects of interventions, the research methodologies and how outcomes are measured.

Ethics and dissemination An approval from a recognised committee is not required to conduct the proposed review, as the study entails secondary analysis of the literature available publicly. For dissemination of the study, the results will be submitted for publication to peer-reviewed scientific journals and presented at relevant public forums and conferences.

INTRODUCTION

Tourette syndrome (TS) is a common neurodevelopmental disorder characterised by the presence of multiple motor and at least one vocal tic, which are present for at least 1 year.¹ TS affects approximately 1 in 100 children² and 1 in 1000 adults³ and is three to four times more common in boys than girls. Simple motor tics are sudden, brief, meaningless movements such as blinking, eye movements, grimacing, nose twitching, mouth movements, head jerks and shoulder movements. Simple vocal tics are sudden, meaningless sounds or noise, such as throat clearing, coughing, sniffing, screeching, barking or grunting. The majority of individuals seen in specialised clinics for tic disorders have comorbid neuropsychiatric conditions, of

Strengths and limitations of this study

- The proposed study will summarise the types of evidence available on the effects of diet, sleep and exercise on tic severity.
- The search strategy will include six databases, the reference lists of all selected studies, as well as a wide range of grey literature sources.
- The proposed study will be limited to publications in English only.

which attention deficit hyperactivity disorder and obsessive compulsive disorder are the most common, with 50% or more of individuals with TS meeting diagnostic criteria for one of these disorders, and approximately 30% diagnosed with all three disorders.⁴ The presence of comorbid disorders has a strong impact on health-related quality of life in children and adults with TS.

Tics characteristically begin in early childhood, peak in severity between 10 and 12 years of age and improve in adolescence. By the age of 16 years, nearly 80% of the youth have either mild, minimal or no tics.⁵ While children and their parents are often reassured by the favourable prognosis for tics in the long run, tics can be impairing when frequent, if they are the cause of unwanted attention, or are a source of emotional distress. Currently available medical interventions for tics can be helpful and have good evidence to support their use, but long-term treatment can be limited by adverse effects.⁶ There is understandable reluctance by many parents to treat their children with medication for tics and many seek other options to help alleviate tics and the distress associated with them. There is good evidence to support the use of behavioural interventions including the Comprehensive Behavioural Intervention for Tics (CBIT).⁷ CBIT, a manualised behavioural therapy consisting of eight treatment sessions over 10 weeks, has demonstrated efficacy in decreasing tic severity in children aged 9

Table 1 Search keywords

Tic	Diet	Exercise	Sleep
Tic disorders	Diet	Exercise	Sleep disorders
Tourette syndrome	Dietary interventions	Sport	Sleep disruption
Tourette	Food	Exercise therapy	Sleep
Tics	Supplements	Physical activity	REM sleep
Gilles de la Tourette syndrome	Nutrition	Intensity	Polysomnography
Tourette disease	Nutrient	Physical exertion	Sleep pattern
Tourette disorder	Vitamins	Exercise training	REM
Tourette's disease	Fatty acids	Physical exercise	Sleep hygiene
Tourette's disorder	Magnesium	Physical effort	Sleep deprivation
Tourette's syndrome	Iron	Exercise movement techniques	Insufficient sleep
Tourette's disease	Sugar		Fragmentation sleep
Tourette's disorder	Amino acids		Monitoring sleep
Tourette's syndrome	Healthy diet		Sleep therapy
Chronic motor and vocal tic disorder	Dietary supplements		
	Food supplements		
	Protein		
	Carbohydrates		
	Fats		
	Caffeine		
	Artificial sugar		

REM, rapid eye movement.

and older as well as adults, with effects sustained for at least 6 months.^{7 8} As treatment must be provided by a trained professional, access to treatment is not universally available.

Tics are known to wax and wane over time from hour to hour, day to day, week to week and month to month, leading to a great deal of introspection on what factors, if any, influence tic severity. Parents and caregivers often ask about the impact of everyday life factors on tics, including diet, sleep and exercise, and if modification of these factors could bring about an improvement in tics. A preliminary search has identified studies examining associations between dietary factors, exercise, sleep and tics,⁹⁻¹¹ as well as interventional studies on the impact of nutritional supplements¹² and physical activity¹³ on tic severity.

The purpose of the proposed scoping review is to undertake an examination of lifestyle factors associated with tic severity to provide direction for our own research study in this area, and advise families seeking information on this topic. Our aim is to map the types of evidence available pertaining to the effect of diet, sleep and exercise on tics and identify key concepts and gaps in research in this area. To our knowledge, there is one previous scoping review on the impact of diet and nutrition on symptoms of TS¹⁴; we believe the proposed scoping review is still needed to review multiple lifestyle factors together.

Methodology and analysis

Protocol design

The proposed scoping review will use the six-step framework recommended by Arksey and O'Malley,¹⁵ with enhancements from Levac *et al*¹⁶ and Joanna Briggs Institute.¹⁷ The steps included are: (1) identifying the research questions, (2) identifying relevant studies, (3) study selection, (4) charting the data, (5) collating, summarising and reporting the results and (6) consultation. Although, the optional sixth step of consulting with stakeholders provides important and relevant input to topic at hand, for this scoping review a formal consultation process will not be included, due to time and budget constraints. Even so, insights from patients, their families and healthcare providers have been informally noted through extensive contact with the patient population.

Step 1: identifying the research questions

The scoping review aims to explore a population with tic disorders and TS, and the concept will be the role of diet, exercise and sleep patterns on tic severity in any setting or age (context). As scoping reviews are explorative in nature, the research question will be refined throughout the review to map all the current literature and identify knowledge gaps. Nonetheless, the objective is to identify factors and interventions associated with positive and negative impacts on tic severity in various settings. The contributing factors and interventions will be analysed

for advantages/disadvantages, limitations, facilitators and effectiveness with regards to tic severity.

Step 2: identifying relevant studies

The literature search will be conducted to include the time frame from inception to June 2018. The key terms used to search the database will be a variation of ‘tics disorder’, ‘TS’, ‘diet’, ‘exercise’ and ‘sleep’ (see [table 1](#)). The search will be performed in June 2018 and the online databases that will be used include MEDLINE (OVID), EMBASE, PsycINFO, Cochrane Central Register of Controlled Trials, CINAHL Plus and Cochrane Database of Systematic Reviews for published studies. A general search of organisation websites such as Tourette Canada and Tourette Association of America will also be conducted to retrieve relevant articles and information pertaining to the study goal. Additionally, grey literature and reference lists from relevant articles (including systematic reviews) will also be searched. For grey literature, a search will be conducted on CADTH Grey Matters, SIGLE, GreyNet, TRIP and AHRQ. Also, a google scholar search will be performed using the time frame and key terms used with the scientific database. The first 200 results of this search will be analysed. Lastly, Web of Science, Movement Disorder Society and the American Academy of Neurology will be searched for the most updated abstracts and conference meetings summaries and ClinicalTrials.gov for intervention studies with results not yet published.

Preliminary study selection criteria include articles published in English language with any type of study methodology or study design, regardless of healthcare setting. We will include participants of any age, gender, or geographical location, who have been diagnosed with TS by a healthcare professional according to the Diagnostic and Statistical Manual for Mental Disorders (any version) or other established diagnostic criteria. As the majority of individuals with TS have comorbid neurodevelopmental or psychiatric disorders, we will include data from individuals regardless of the presence of comorbid disorders. All non-human subjects based studies and articles in languages other than English will be excluded from the literature search.

Step 3: study selection

The combined search through all the databases will be imported to a citation software and duplicate search results will be eliminated. Two reviewers will independently screen titles and abstracts from the search results according to the criteria set for inclusion and exclusion. To resolve uncertainties, a discussion among the authors will be conducted until a consensus is reached.

Step 4: charting the data

For the selected titles and abstracts, full articles will be obtained and reviewed by two authors. The charting of data will be divided among two authors, with verification of extracted information performed by a third author. A data extraction form [table 2A,B](#) will be used to tabulate pertinent

Table 2A Data extraction form for association studies

Main category	Subcategory
1. Authors	
2. Title	
3. Journal	
4. Year of publication	
5. Location of study	Country Organisation Type of practitioners
6. Primary study objective	
7. Additional objective(s)/Research question(s)	
8. Type of study	
9. Participant characteristics	Sample size Sex Mean age Comorbidities
10. Dietary associations studied	Dietary supplements Dietary triggers Dietary modification/special diets Dietician consultation
11. Sleep associations studied	Sleep comorbidities Sleep physiology
12. Exercise associations studied	Aerobic exercise programmes Physical activities
13. How tic outcome variables examined	Yale Global Tic Severity Scale Global Tic Rating Scale Tic Symptom Self Report Video records Other
14. Main findings on the effect of the intervention on tics	
15. Most important finding	
16. Other relevant findings	
17. Conclusions	
18. Study limitations	
19. Authors recommendations	

information. In order to validate the form, a pilot test will be conducted after revision and charting of 5–10 studies. The data extraction form will be modified to include and exclude variables during the charting process.

Step 5: collating, summarising and reporting the results

Using the data extraction form [table 2A,B](#), analysis of the selected studies will be presented through descriptive methods (quantitative and qualitative) of the information relating to diet, exercise and sleep patterns on tic severity. Study characteristics (eg, type of study, location

Table 2B Data extraction form for intervention studies

Main category	Subcategory	Description
1. Authors		
2. Title		
3. Journal		
4. Year of publication		
5. Location of study	Country Organisation Type of practitioners Context	
6. Primary study objective		
7. Additional objective(s)/research question(s)		
8. Type of study		
9. Participant characteristics	Sample size Sex Mean age Comorbidities	
10. Intervention 1: dietary	Dietary supplements Dietary triggers Dietary modification/special diets Dietician consultation	Type Delivery (how and by whom) Type of provider Frequency Duration Dosage
11. Intervention 2: for sleep		
12. Intervention 3: exercise	Aerobic exercise programmes Physical activities	Type Frequency Duration Intensity
13. How tic outcome variables examined	Yale Global Tic Severity Scale Global Tic Rating Scale Tic Symptom Self Report Video records Other	
14. Main findings on the effect of the intervention on tics		
15. Most important finding		
16. Other relevant findings		
17. Conclusions		
18. Study limitations		
19. Authors recommendations		

of study and year of publication), population characteristics (eg, sample size, mean age, sex and comorbidities) and intervention characteristics (eg, context, types, providers, dose, duration, frequency and intensity) will be documented. Where applicable, data will be organised visually into charts and tables to relay an overview of the study findings.

Patient and public involvement

Patients and public were not formally involved in the development of this protocol, however, the development of the research question was informed by decades of clinical experience working with patients and families

affected by tic disorders, in acknowledgement of their interest in non-pharmacological therapies.

ETHICS AND DISSEMINATION

As for dissemination of the study, the results will be submitted for publication to peer-reviewed scientific journals and presented at relevant public forums and conferences. The findings of the review are predicted to organise literature available and enlighten on knowledge gaps pertaining to the research topic. Furthermore, the results of the scoping review will determine the benefits

of conducting a systematic review. Additionally, the results will be available to policy-makers, healthcare providers and patients to effectively modify lifestyle patterns and tic severity.

CONCLUSION

The proposed review will map the types of evidence available pertaining to the effect of diet, sleep and exercise on tics. The standardised language framework will tie together the sparse and varied literature and help identify the scope, depth, key themes and gaps that exist. The results from the scoping review will inform and guide our next research study in this area, and advise families seeking information on this topic.

Contributors EN and SS drafted the manuscript. TP, ZSG and DM designed the study and read and revised the manuscript. All authors approved the final manuscript submitted.

Funding This work was supported by the Owerko Centre at the Alberta Children's Hospital Research Institute.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval An approval from a recognised committee is not required to conduct the proposed review, as the study entails secondary analysis of the literature available publicly.

Provenance and peer review Not commissioned; externally peer reviewed.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

REFERENCES

1. American Psychiatric Association. *Diagnostic and statistical manual of mental disorders (DSM-5®)*: American Psychiatric Pub, 2013.
2. Knight T, Steeves T, Day L, *et al*. Prevalence of tic disorders: a systematic review and meta-analysis. *Pediatr Neurol* 2012;47:77–90.
3. Yang J, Hirsch L, Martino D, *et al*. The prevalence of diagnosed tourette syndrome in Canada: A national population-based study. *Mov Disord* 2016;31:1658–63.
4. Hirschtritt ME, Lee PC, Pauls DL, *et al*. Lifetime prevalence, age of risk, and genetic relationships of comorbid psychiatric disorders in Tourette syndrome. *JAMA Psychiatry* 2015;72:325–33.
5. Groth C, Mol Debes N, Rask CU, *et al*. Course of Tourette Syndrome and Comorbidities in a Large Prospective Clinical Study. *J Am Acad Child Adolesc Psychiatry* 2017;56:304–12.
6. Pringsheim T, Doja A, Gorman D, *et al*. Canadian guidelines for the evidence-based treatment of tic disorders: pharmacotherapy. *Can J Psychiatry* 2012;57:133–43.
7. Piacentini J, Woods DW, Scahill L, *et al*. Behavior therapy for children with Tourette disorder: a randomized controlled trial. *JAMA* 2010;303:1929–37.
8. Wilhelm S, Peterson AL, Piacentini J, *et al*. Randomized trial of behavior therapy for adults with Tourette syndrome. *Arch Gen Psychiatry* 2012;69:795–803.
9. Lee WT, Huang HL, Wong LC, *et al*. Tourette Syndrome as an Independent Risk Factor for Subsequent Sleep Disorders in Children: A Nationwide Population-Based Case-Control Study. *Sleep* 2017;40.
10. Müller-Vahl KR, Buddensiek N, Geomelas M, *et al*. The influence of different food and drink on tics in Tourette syndrome. *Acta Paediatr* 2008;97:442–6.
11. Mantel BJ, Meyers A, Tran QY, *et al*. Nutritional supplements and complementary/alternative medicine in Tourette syndrome. *J Child Adolesc Psychopharmacol* 2004;14:582–9.
12. Gabbay V, Babb JS, Klein RG, *et al*. A double-blind, placebo-controlled trial of ω -3 fatty acids in Tourette's disorder. *Pediatrics* 2012;129:e1493–e1500.
13. Packer-Hopke RM L. A preliminary investigation of the effects of aerobic exercise on childhood Tourette's syndrome and OCD. *The Behavior Therapist* 2014.
14. Ludlow AK, Rogers SL. Understanding the impact of diet and nutrition on symptoms of Tourette syndrome: A scoping review. *J Child Health Care* 2018;22:68–83.
15. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol* 2005;8:19–32.
16. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implement Sci* 2010;5:69.
17. Peters MD, Godfrey CM, Khalil H, *et al*. Guidance for conducting systematic scoping reviews. *Int J Evid Based Healthc* 2015;13:141–6.