Physical activity, diet and supplements for people with Tourette syndrome or persistent tic disorders

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Objectives

To review published data on supplements, dietary triggers and special diets in people with TS

To review published data on the effect of exercise on tics

To discuss the results of a study performed at the Calgary Tourette and Pediatric Movement Disorders clinic on the relationship between physical activity and tics

Why I am giving this talk

Area of great interest to parents

Most frequently asked question in the clinic

Very little high quality research has been performed

Yale Global Tic Severity Scale

- Most extensively used and recommended scale for measuring tic severity
- Clinician rated measurement of tic number, frequency, intensity, complexity, interference and overall impairment, based on patient report and observation
 - Motor and vocal tics scored separately
- Period of one week
- Total tic score 50 points
- Overall impairment score 50 points

Dietary supplements



Omega 3 fatty acid supplements

Omega 3 found in fish/seafood, nuts, seeds, plant oil

Randomized controlled trial of 20 weeks in 33 children aged 6-18

Children randomized to omega-3 fatty acid supplementation (500-1000 mg) or placebo (olive oil capsules)

No significant difference between treatment groups in tic severity

BUT: Children randomized to omega-3 had lower tic-related impairment



Taurine

Class III randomized, double-blind, placebocontrolled study of oral taurine added to tiapride in children with mild to severe tics

Amino acid available naturally in meat, fish, dairy products and dietary supplements

Agonist at GABA A receptors

Proposed to enhance inhibitory neurotransmission

Taurine

Dosage of taurine not stated

Randomly assigned to 12 weeks of oral taurine (n=133) or placebo (n=249)

Children between ages of 6 and 16

All children also treated with tiapride

Primary outcome: Improvement in tics, defined as a more than 60% reduction in the YGTSS Global Severity Score compared with baseline

Taurine



Week 12



53% of taurine group showed improvement in tics, compared with 35% in the placebo group



Drowsiness most common adverse effect, but no significant difference between groups

Vitamin D

Class IV prospective open label study of vitamin D supplementation in children with tics and vitamin D insufficiency (10-30 ng/mL) or deficiency (<10)

120 children with chronic tic disorders had their vitamin D levels measured and compared with 140 matched healthy controls

Vitamin D

Children with tics had significantly lower vitamin D levels than controls

19 ng/mL vs 29 ng/mL (p<0.001) 93% of children with tics had insufficient or deficient vitamin D levels compared to 56% of controls (p<0.001)

Vitamin D3 supplementation in children with chronic tic disorders

- 60 children with vitamin D insufficiency or deficiency were given vitamin D supplementation at a dose of 300 IU/kg/day (max dose 5000 IU)
- 36 children completed 3 months of supplementation
- After 3 months, mean serum vitamin D levels rose from 21 to 51 ng/mL, and the mean YGTSS TTS fell from 23 to 13 (both p<0.001)



Natural Supplements and complementary/alternative medicine (CAM): Uncontrolled study

Mantel 2004: Questionnaire to patients about use of supplements and CAM to help control tics

Supplements used: vitamins B, C, E, calcium, magnesium

Improvement in tics in under 11s was 70% (motor) and 55% (vocal)

11 to 18: 69% (motor) and 67% (vocal)

Adults: 50% (motor) and 42% (vocal)

Worsening of tics reported in 3.5%



The Bottom Line: Supplements for Tics

- Very little controlled data on the effect of supplements on tics
- Omega 3 Recommended Dietary Allowance (RDA) not established
 - Doses of 500-1000 mg per day believed to be safe
- Vitamin D RDA 600 IU
- Taurine RDA not established; dose not discussed in research study

Dietary Triggers

Study of influence of food and drink on tics

Questionnaire completed by 224 people from the Tourette outpatient clinic and the German TS selfaid group

Participants were asked to rate tic severity and indicate if they had ever felt an influence of 32 different foods and drinks on their tics

- 65/169 respondents reported that "coke" worsened tics
- 43/126 found that tics were worsened by coffee
- 27/120 by black tea
- 39/177 by preserving agents
- 36/193 by refined sugar

No foods were associated with improvement in tics



Connection between TS and excitatory substances

- Study: cross-sectional study of children with TS (Zou 2011) and controls
- Looking for connection between Tourette syndrome and excitatory substances
- 3/44 children with TS tested positive for excitatory substances compared to 0/44 controls
- Ephedrine

Effects of Caffeine

Study: case series (Davis)

Caffeine consumption in two boys aged 13 and 11

Both boys were observed for 3 years

13 YO: caffeine free diet for 6 months – tics completely disappeared

11 YO: removed caffeine from his diet, within two weeks tics disappeared



Dietary modification/special diets

- Study: randomized, double blind, placebocontrolled trial (Rasmusson)
- Effect of tryptophan (found in milk, tuna, cheese, chicken, nuts) depletion on tics
- Controlled experiment lasted 2 days
- No change in self-rated tic severity response to tryptophan depletion



The Bottom Line: Dietary Triggers

- Avoid caffeine
- Everyone is different
- Pay attention to possible associations between tic exacerbations and dietary factors trial of elimination

TS: dietary factors and gut microbiome

- TS is associated with immune responses chronically linked with inflammatory processes
- Microbial fermentation of dietary fibre may be important in the regulation and activation of inflammatory reactions in the gut
- This could be relevant to TS
- Beneficial effect of Omega-3 polyunsaturated fatty acids supplementation may be mediated by gut microbiome
- Fatty acids influence neurobehavioral development, anxiety and social behaviours



Aerobic Exercise



Acute effect of exercise

- Study: (Nixon) open label, non-randomized acute intervention
- To measure mean tic rate in different phases of exercise
- Kickboxing exercise delivered through X-Box
- Three distinct sessions: pre, during exercise, post
- During exercise tics lowered significantly
- Tics increased post exercise but were still significantly lower than pre exercise

Chronic effect of exercise

- Chronic effect of exercise on tic severity evaluated in 5 male children with a six week exercise program consisting of two 30 minute sessions per week of moderate to vigorous intensity exercise (Packer-Hopke 2012)
- All participants experienced a decrease in tic severity compared to baseline on clinician and parent rating scales



Physical Activities

Physical Activities

- Cross-sectional study (Doja)
- Tic severity was measured in 13 children using the YGTSS
- Physical activity was monitored and assessed via a pedometer for 7 Days
- Vocal tic severity scores in those who were more active were lower, but there was no difference in motor tic scores.

Physical activities

O'Connor studied behavioural activities associated with the onset of symptoms in adults with chronic tics Participants completed a form ranking three high risk activities where tics were likely to appear, and three low risk activities where tics were absent or barely present.

Ranking was based on a daily diary kept over at least 10 days.

32% reported physical exercise as a low risk activity (tics absent or barely present), and 2% reported physical exercise as a high risk activity (tics were likely to appear)



Study: Physical activity, sleep and neuropsychiatric symptom severity in children with Tourette syndrome

- Study performed at the Calgary Tourette and Pediatric Movement Disorders Clinic
- Objective: to examine association between physical activity, sleep and symptom severity in children with tic disorders
- Comorbid symptom severity also examined in relation to sleep and physical exercise/activity
 - ADHD, OCD, anxiety and depression



Sleep and tics

- Many studies reporting a high prevalence (up to 60%) of sleep disturbances in individuals with TS
 - Trouble initiating and maintaining sleep
 - Increased motor activity during sleep
 - Anxiety/fear while falling asleep
- Tics observed in all stages of sleep

Wrist-worn accelerometer



Waterproof, can measure for up to 45 days

GeneActiv Device

Measures acceleration, light and temperature



Extensively used in activity and sleep research in children and adults

GeneActiv Device: Activity Measurements



GeneActiv Device: Sleep Measurements Going to bed time

Bed duration

Non-wear time

Total sleep time

Sleep efficiency

Number of activity periods

Median duration of activity periods

	Age and sex	Comorbidity and medication
Other Data Collected	Physical activity questionnaire	Sleep diary

Sleep disturbance scale for children

Study population characteristics

- 110 participants with TS or PMTD
 - ADHD 49%
 - GAD 29%
 - OCD 26%
 - MDD 8%
 - Autism 6%
- Children with more severe tics reported more sleep disturbances and greater sedentary activity time on questionnaires



Key findings

- Tic severity correlated directly with the amount of sedentary activity time on the GeneActiv device measurements, and inversely with the cumulative amount of light, moderate and vigorous activity time
- The more time the child was sedentary, the higher their tic scores were
- Similar correlations found for OCD, anxiety and depression symptoms, but not ADHD symptoms
- Strongest association demonstrated between anxiety symptoms and sedentary activity time

Key findings

No relationship between measured sleep time on the GeneActiv device and tic severity, or severity of ADHD, OCD, anxiety or depression

ADHD symptom severity was most strongly correlated with sleep disturbances on questionnaire What is the mechanism of action for exercise as a treatment for tics?

Acute physiological effects of exercise

- Reduced levels of anxiety and increased levels of positive affect following acute bout of exercise
- Vigorous exercise can acutely increase serotonin levels
- Body movements associated with exercise may replace tics
 - Distraction
 - Sensory trick

What is the mechanism of action for exercise as a treatment for tics? Chronic physiological adaptations occur with physical training

- Sympathoinhibition and enhanced vagal outflow
 - Alpha agonists helpful as treatment for tics, suggesting increased central noradrenergic activity may be associated with tic disorders
- Lowers basal extracellular dopamine levels
 - Positive effects of antidopaminergic drugs on tics
- Exercise training improves anxiety
 - Anxiety exacerbates tics

Biological Plausibility

- Exercise has been shown to have a positive effect across a wide range of neurological and psychiatric illnesses
- Cognitive impairment
- Depression
- Anxiety
- Psychosis
- Migraine
- ADHD



Diet and Exercise: ADHD

ADHD is commonly comorbid with TS

ADHD parental symptom scores improved significantly with Omega-3 supplementation

Evidence that exercise programs positively affect physical, mental and social well-being in youth with ADHD

Acute and long-term effects of exercise are reported

Dietary and exercise interventions for ADHD may indirectly improve tic-related disability

Diet and Exercise: anxiety

Anxiety disorders common in individuals with TS

A US survey of 8098 people ages 15-54 found regular physical activity associated with significant decrease of anxiety disorders

Recent review on the effect of exercise on anxiety and stress found anxiety symptoms decreased compared to control conditions

Tics disorders often worse in individuals with coexisting anxiety

Interventions for anxiety may indirectly improve tics

Diet and physical activity on tics



Current evidence on the effect of diet and physical acticity on tics is limited



Most evidence is of low quality



Further research is required to confirm if dietary changes and a physically active lifestyle has a lasting effect on tic severity



Studies suggest exercise has a positive effect on tics