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## Case report

## Higher adherence to the Mediterranean diet is associated with reduced tics and obsessive-compulsive symptoms: A series of nine boys with Obsessive-Compulsive Tic Disorder



*Une plus grande adhésion au régime méditerranéen est associée à une réduction des tics et des symptômes obsessionnels compulsifs : une série de neuf garçons atteints du Trouble du Tic Obsessionnel-Compulsif*

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## ABSTRACT

Tics and obsessions-compulsions are consistent phenotypes of the Obsessive-Compulsive Tic Disorder (OCTD), frequently associated with male gender, sensory phenomena, and impulsive behaviors. These clinical symptoms were reported to influence eating behaviors, but literature also showed that food patterns or dietary supplements could alleviate the clinical spectra, thus suggesting the existence of a bidirectional association. We present a series of 9 boys with OCTD from Italy whose unhealthy food habits were corrected through a nutritional counseling. The education focused on promoting a balanced diet through non-specific Mediterranean dietary advices. After one month, YGTSS (Yale Global Tic Severity Scale) and Y-BOCS (Yale-Brown Obsessive Compulsive Scale) scored a significant reduction, but the quality of life diminished. First, we conclude that healthier dietary patterns may be associated with an amelioration of tics and obsessive-compulsive traits in boys who are diagnosed with the same conditions. Second, the impact of nutritional interventions on the quality of patients' life, especially if underage, should always be considered. Certainly, the treatment of OCTD must be multidisciplinary and should include neuropsychiatrists, clinical psychologists, and nutritionists. The nutritional counseling should be as comprehensive as possible to promote a balanced diet, and inform about nutritional side effects of drugs or potential food-drug interactions.

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## R É S U M É

Les tics et les obsessions-compulsions sont des phénotypes cohérents du Trouble du tic obsessionnel-compulsif (TTOC), fréquemment associés au sexe masculin, aux phénomènes sensoriels et aux comportements impulsifs. Ces symptômes cliniques pourraient influencer les comportements alimentaires, mais la littérature a également montré que les schémas alimentaires ou les compléments

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Tics  
 Troubles obsessionnels-compulsifs  
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alimentaires pouvaient atténuer les spectres cliniques, suggérant ainsi l'existence d'une association bidirectionnelle. Nous présentons une série de 9 garçons italiens atteints de TTOC, dont les habitudes alimentaires malsaines ont été corrigées grâce à des conseils nutritionnels. L'éducation s'est concentrée sur la promotion d'une alimentation équilibrée par le biais de conseils diététiques méditerranéens non spécifiques. Après un mois, le YGTSS (Yale Global Tic Severity Scale) et le Y-BOCS (Yale-Brown Obsessive Compulsive Scale) ont été significativement réduits, mais la qualité de vie a diminué. Premièrement, nous concluons que des habitudes alimentaires plus saines peuvent être associées à une amélioration des tics et des traits obsessionnels-compulsifs chez les garçons avec le même diagnostic. Deuxièmement, l'impact des interventions nutritionnelles sur la qualité de vie des patients, surtout s'ils sont mineurs, devrait toujours être pris en compte. Le traitement des TTOC doit être multidisciplinaire et doit inclure des neuropsychiatres, des psychologues cliniciens et des nutritionnistes. Les conseils nutritionnels doivent être aussi complets que possible, afin de promouvoir une alimentation équilibrée et informer sur les effets secondaires nutritionnels des médicaments ou sur les interactions potentielles avec les médicaments.

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## 1. Introduction

Gilles de la Tourette syndrome (GTS) is a neurodevelopmental movement disorder characterized by motor and phonic tics [1]. Obsessions and compulsions may be present, thus depicting the more severe phenotype termed Obsessive-Compulsive Tic Disorder (OCTD) [2] that is frequently associated with male gender, sensory phenomena, and impulsive behaviors [3]. Considering the phenotype complexities and the high level of functional impairment caused by OC symptoms, a tailored, personalized, and multidisciplinary treatment is considered a priority. Pharmacological treatment primarily comprises antipsychotics and antidepressants, which are known, among other factors, to be associated with higher risks for cardiometabolic disorders [4] probably because of appetite and metabolic alterations. Moreover, patients' OC behaviors can further vitiate food habits [5], and impulsive eating was reported to be present in about 40% of patients with tics [6]. Other than environmental factors, bad eating choices may be also driven by an altered sensory sensitivity [7]. Considering complementary medicine approaches, different food patterns or dietary supplements were frequently reported to alleviate clinical symptoms. For instance, supplements, sugar-free diets, gluten-free diets, or oligo-antigenic diets were investigated with positive results [8], mainly attributed to gut microbiota modulations [9]. In 2016, the standard of care of Tourette's Syndrome and Movement Disorders Centre in Milan, Italy was implemented with a nutritionist for those patients that required a nutritional support [6]. Low baseline adherence to the Mediterranean diet (MD), learned helplessness for previous attempts to lose weight, family environment affecting food habits, displeasure of body image, fear of gain in body weight, nutrition-related side effects of pharmacological therapy, or impulsive eating have since been managed. With boys disproportionately affected by tics, here are presented and reviewed 9 similar cases of OCTD male children that were admitted to the Centre and who experienced an amelioration of clinical symptoms after a non-specific nutritional counseling. No other similar cases that could have been included in this report were excluded. All patients displayed a general consent to use their medical information for research purposes. In order to provide consistent and transparent information, the CAsE Report (CARE) guidelines (<https://www.care-statement.org/resources/checklist>) for reporting case reports/case series were followed.

## 2. Report of the cases

Nine boys suffering from OCTD, with a mean age of  $14.4 \pm 2.4$  years (11; 18), were admitted non-consecutively at Tourette's

Syndrome and Movement Disorders Centre in Milan, Italy between January and March 2018 for an ordinary control of the clinical symptoms. The neurologist and the clinical psychologist visited the patients who all were previously known for being partial treatment-responders. No past interventions, comorbidities, or OC traits that could affect food habits were known. Tic severity with social impairment and OC symptoms were evaluated through the Yale Global Tic Severity Scale (YGTSS) and the Yale-Brown Obsessive Compulsive Scale (Y-BOCS), respectively. The perceived health-related quality of life (QOL) was also assessed to monitor satisfaction through a visual analog scale for children. Baseline treatment related variables were summarized in Table 1. A total of 6 out of 9 boys reported to do vigorous sport >2 times per week. Because of testified unhealthy eating behaviors, patients were referred to the nutritionist for a nutritional evaluation. The MD pattern – i.e. the food lifestyle universally recognized as the healthiest – was assessed through the KIDMED index [10], which effectively investigates the MD adherence in children and youths between 2 and 24 years old. Because of the low baseline adherence, as evidenced by a mean KIDMED score of  $3 \pm 1.7$  (0–5), patients and their parents were addressed for the nutritional counseling.

All boys were underage and showed a moderate Y-BOCS score, therefore it was not recommended to impose diet restrictions in order to avoid future food insecurities or expose to potential eating problems. Boys and their parents were educated to pursue better eating habits as follows: to eat more than one fruit every day, to consume vegetables more than once a day, to consume fish at least 2–3 times/week, to avoid fast food restaurants, to eat pulses more than once a week, to consume pasta or rice almost every day, to consume nuts at least 2–3 times/week, to use olive oil, to have breakfast with dairy products, to take two yoghurts and/or some cheese daily, to avoid commercially baked goods, pastries, sweets, or candies. Dietary recommendations focused on the KIDMED items to increase the score  $\geq 8$  points, which corresponds to a high adherence. The counseling sessions lasted one hour each and ended with the delivery of a nutritional booklet that summarized all abovementioned information. After one month, patients were scheduled for a 1-month follow-up visit and same neurologist, clinical psychologist, and nutritionist monitored the progresses of dietary habits, neuropsychiatric symptoms, and quality of life. Results were reported in Table 2.

## 3. Comments

After the nutritional counseling that focused on promoting the Mediterranean pattern, the KIDMED score increased significantly, whilst both YGTSS and Y-BOCS scores decreased significantly

**Table 1**  
Treatment related variables of nine boys with OCTD.

Patient	Pharmacological therapy					Clinical Indexes			
	Antipsychotics	Antihypertensive	Anticonvulsants	Anxiolytic	Antidepressant	YGTSS	Y-BOCS	QOL	KIDMED
1	Aripiprazole Pimozide	Clonidine	–	–	–	84	20	60	3
2	HaloperidolPromazine	–	–	Delorazepam	Sertraline	92	18	90	1
3	Risperidone	–	Topiramate	–	–	39	14	70	5
4	Risperidone	–	Topiramate	–	–	57	22	85	5
5	Tiapride Pimozide	–	–	–	Fluvoxamine	38	22	85	4
6	Aripiprazole	–	–	–	–	61	15	75	2
7	Perphenazine	Clonidine	–	–	Sertraline	76	12	100	3
8	Pimozide	–	–	–	Paroxetine	35	7	95	4
9	Ziprasidone	Clonidine	–	–	Citalopram	58	10	50	0

YGTSS (total tic severity score + impairment) score: 0–100. Y-BOCS score (0–40): 0–7 points: subclinical, 8–15 points = mild, 16–23 points: moderate, 24–31 point: severe, 32–40 points: extremely severe. QOL score: 0–100. KIDMED index score (0–12):  $\leq 3$  points: poor, 4–7 points: medium,  $\geq 8$  points: high.

**Table 2**  
Progress of dietary, neuropsychiatric, quality of life scores after the nutritional counseling.

Section 2.1	Before nutritional counseling First visit	After nutritional counseling + 30 days	$\Delta$ (after – before)	p-value
KIDMED	3.0 $\pm$ 1.7 (0.0; 5.0)	8.6 $\pm$ 1.9 (6.0; 11.0)	+5.6 $\pm$ 1.4	<0.01
Body weight	65.8 $\pm$ 17 (45.2; 97.4)	64.6 $\pm$ 17.9 (40.0; 96.5)	–1.2 $\pm$ 2.3	0.192
YGTSS	60.0 $\pm$ 20.7 (35.0; 92.0)	46.9 $\pm$ 25.0 (4.0; 89.0)	–13.1 $\pm$ 11.4	<0.05
Y-BOCS	15.6 $\pm$ 5.3 (7.0; 22.0)	7.9 $\pm$ 5.3 (0.0; 18.0)	–7.7 $\pm$ 2.7	<0.01
QOL	78.9 $\pm$ 16.5 (50.0; 100.0)	68.8 $\pm$ 26.8 (5.0; 90.0)	–10.1 $\pm$ 22.8	0.342
Section 2.2	$\Delta$ KIDMED	$\Delta$ YGTSS	$\Delta$ Y-BOCS	$\Delta$ QOL
$\Delta$ KIDMED	1	–	–	–
$\Delta$ YGTSS	0.265	1	–	–
$\Delta$ Y-BOCS	–0.786*	–0.477	1	–
$\Delta$ QOL	–0.039	0.377	–0.176	1

Continuous values were reported as mean  $\pm$  standard deviation (min; max). All values were skewed and were analyzed through the Wilcoxon signed-rank test. Spearman's correlation was used to analyze associations between the delta ( $\Delta$ ) changes of KIDMED, YGTSS, Y-BOCS, and QOL.

\* For Spearman's correlations:  $P < 0.05$ .

despite the small sample size. The delta ( $\Delta$ ) changes of clinical indexes were subsequently correlated to investigate the correlation pattern, and  $\Delta$ Y-BOCS resulted to be associated with  $\Delta$ KIDMED. Data literature showed a similar reduction of clinical symptoms after the introduction of a gluten-free diet or omega-3 fatty acids [8]. According to clinicians' perspective, there was no other identifiable reason than MD diet that could have been associated to the modification of the clinical spectrum, except the possible natural history of the disease. In fact, it is possible that higher consumption of certain foods modulated gut microbiota that could, in turn, affect the nervous system physiology and function via the gut-brain axis. However, it is also plausible that the nutritional education incorporated a new daily personal control that could influence the OC traits of OCTD boys. Patients' satisfaction was assessed through the QOL score changes that seemed to mirror a worsening of the overall well-being perception. Probably, the removal of sweets, candies, cheeseburgers or the introduction of notoriously unpleasant foods (e.g. pulses) might have been perceived as a negative element in a teenage life. Even if the reduction was not statistically significant, the mean QOL score after the nutritional counseling should be a warning for those health professionals studying food habits in children. A more gradual and long lasting modification of eating habits could have ensured better acceptance than the 1-month intervention.

#### 4. Conclusions

The primary "take-home message" from this case series is that the MD may be associated with an amelioration of tics and OC traits in boys who are diagnosed with OCTD. Despite these conclusions may not be generalized beyond the context of these cases, it is reasonable to think that healthier eating habits would

contribute to promote an overall physical and mental well-being that may positively influence clinical symptoms in patients with the same conditions. Whether the nutritional education may have acted directly through gut microbiota modifications [9] or indirectly through the amelioration of OC traits, the better adherence to the MD is important for the cardiometabolic risk prevention. Moreover, the nutritional education is most effective at a young age when passive learning is more efficient.

Second, health professionals should always consider the impact of a nutritional intervention on the quality of life of the patient, especially if underage. Certainly, the MD is much more enjoyable and acceptable than other dietary approaches that focus on food restriction or that take away the pleasures of attending birthday parties or other community meetings. The sooner the boys begin to follow a restrictive and/or selective dietary regime, such as the gluten-free diet or the oligo-antigenic diet, the more likely they are to give up precociously because of its social incompatibility. Especially for children who report a low severity of tics or OC traits, to pursue a diet that has only partial evidence to alleviate clinical symptoms, is not acceptable. Patient's and caregiver's information and education is the safest way to pass on awareness and reasoning, and these latter should be the purpose of the nutritional counseling.

Third, the treatment of OCTD must be multidisciplinary and should include neuropsychiatrists, clinical psychologists, and nutritionists. The role of the nutritional support appears increasingly valuable not only in managing the nutrition-related side effects of drugs or impulsive eating, but it also in ameliorating clinical symptoms. Future studies are required to investigate the effects of specific foods or dietary patterns in larger neuropsychiatric populations, with any nutritional intervention being as comprehensive as possible to include the promotion of a balanced diet [5], information about nutritional side effects of drugs (e.g. alteration of

orexigenic/anorexigenic signals) [11], potential food–drug interactions [12].

### Disclosure of interest

The authors declare that they have no competing interest.

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