

Effects of toxic oil syndrome on the psychological conditions of the descendants of affected persons

Effetti della Sindrome da olio tossico sulle condizioni psicologiche dei discendenti delle persone affette

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What is already known on this topic

- Patients having experienced the Toxic Oil Syndrome (TOS) in the 80s, in addition to organic acute and chronic changes, developed different degrees of anxiety and depression.
- Living together with chronically ill patients entails a risk of suffering from psychosomatic disorders.

What this study adds

- Children born from long-term TOS survivors in school age do not exhibit psychological changes to a greater extent than control children, at least within the domain of the response to the questionnaires which have been used.

Abstract

Objective: in May 1981, the Toxic Oil Syndrome (TOS) affected over 20,000 people, in Spain, as a result of the ingestion of rapeseed oil that had been denatured with 2% aniline. Amongst many physical and organic problems, many patients in this cohort showed different degrees of anxiety and depression. It can be hypothesized that their children might well be susceptible to suffer from anxiety, depression and other psychological disturbances.

Methods: children with a father and/or mother included in the official TOS census, who were born between 1st January 1983 and 31st December 1989 and resided in Madrid (n. 420, response rate 84%), were compared against high-school children of TOS-free parents of the same age and similar socioeconomic status (n. 327).

Data collection: Spanish version of Goldberg and Hillier's General Health Questionnaire (GHQ-60) and Cattell's High

School Personality Questionnaire (HSPQ).

Results: the only statistically significant difference between the two groups was the sleep disturbance factor of the GHQ-60 questionnaire. Significant differences were not observed in any of the personality factors (such as anxiety, depression, excitability and introversion) analysed by the HSPQ questionnaire when the exposed group was considered as a whole. However, in the replies to the HSPQ questionnaire, some statistically significant differences between exposed and non exposed children were detected in analyses carried out separately in each sex.

Conclusions: the results of this study tend to rule out any impairment of the mental health of children born from parents who had been TOS victims.

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Keywords: descendants, GHQ, HSPQ, toxic oil syndrome

Riassunto

Obiettivo: in Spagna, nel maggio 1981, la Sindrome da olio tossico (Toxic Oil Syndrome, TOS) colpì oltre 20.000 persone, a causa dell'ingestione di olio di colza che era stato denaturato con il 2% di anilina e, successivamente, raffinato in maniera fraudolenta. Tra le diverse conseguenze sulla salute, molte vittime mostrarono ansietà e depressione in diversi gradi. Si può ipotizzare che i figli delle persone colpite dalla TOS possano essere predisposti a soffrire di ansietà, depressione e altri disturbi psicologici.

Metodi: i figli nati tra gennaio 1983 e dicembre 1989 da persone incluse nel censimento ufficiale delle vittime della TOS e residenti a Madrid (n. 420, rispondenti 84%), sono stati confrontati con studenti delle scuole superiori della stessa età e simile stato socioeconomico, nati da genitori non affetti da TOS (n. 327).

Raccolta di dati: versione spagnola del General Health Questionnaire (GHQ-60) di Goldberg and Hillier e del High School Personality Questionnaire (HSPQ) di Cattell.

Risultati: l'unica differenza statisticamente significativa tra i

due gruppi ha riguardato il fattore disturbo del sonno, presente nel questionario GHQ-60. Non vi erano differenze statisticamente significative per altri fattori della personalità (come ansietà, depressione, eccitabilità e introversione) analizzati attraverso il questionario HSPQ, quando il gruppo esposto veniva considerato nella sua totalità. Tuttavia, alcune differenze sta-

tisticamente significative sono state identificate in analisi condotte separatamente per ciascun sesso.

Conclusioni: i risultati dello studio tendono a escludere ogni coinvolgimento della salute mentale dei figli delle vittime della TOS. (*Epidemiol Prev* 2008; 32(4-5): 212-17)

Parole chiave: discendente, GHQ, HSPQ, Sindrome da olio tossico

Abbreviations

GHQ:	General Health Questionnaire
GADS:	Goldberg Anxiety and Depression Scale
HSPQ:	High School Personality Questionnaire
IIER:	Instituto de Investigación de Enfermedades Raras
TOS:	Toxic Oil Syndrome
LM:	left-meaning
RM:	right-meaning

Introduction and current status

The Toxic Oil Syndrome (TOS) suddenly appeared in Spain in May 1981, affecting over 20,000 people.¹ The outbreak resulted from the ingestion of a batch of rapeseed oil that had been denatured with 2% aniline and later fraudulently refined.² Clinically, TOS was a multisystemic condition developing through three phases.^{3,4} Over time, many survivors underwent remission of their main clinical symptoms, but the prevalence of patients with pulmonary, cutaneous and neurological sequelae remained sizable. Also, cramps, myalgias and contractions persisted.

A study using the Nottingham Health Profile,⁵ showed that TOS patients consider themselves as having a very poor state of health. In other studies, the Goldberg Anxiety Depression Scale (GADS) pointed out to the presence of anxiety and depression.⁶ Our centre has been following-up the cohort of TOS patients,⁴ including the collection of data on their offspring. This led to the identification of 3,976 births registered nationwide during the first 10 years after the outbreak.

A review of the literature indicates that, from an organic and mental or psychological standpoint, living together with chronically ill patients entails a risk of suffering from psychosomatic disorders, anxiety, depression and related problems.⁷⁻¹¹ The association is particularly relevant for the children of such patients.¹²⁻¹⁸ Given that TOS patients suffer from chronic pain, anxiety and depression, it is to be wondered whether children of affected parents might be susceptible to anxiety or depression, or are predisposed to somatization or to other psychological changes. This was what the current study sought to ascertain.

Methods

Study design.

This cross-sectional study compared children of TOS-affected parents («cases») against a group of pre-adolescents and adolescents born from TOS-free parents of the same age and similar socioeconomic status. Only children living in the city of Madrid were included in the study, which was performed in 2001.

Study population

Case definition: any child born from a father and/or mother included in the official TOS census, born between 1st January 1983 and 31st December 1989 and living in Madrid (n. 546). Individuals born between the outbreak of the epidemic and 1983 (137 children) were not included in the study due to the difficulty to find an adequate control group.

Out of 546 eligible cases, 45 were excluded due to the following criteria: 18 lived outside Madrid at the time of the study; 18 did not live with the father at the time of the study; 4 were mentally handicapped and could not respond to the questionnaires; 3 were born out of the range of the study and 2 had died. Table 1 shows the age and sex distribution of the 501 children eventually included in the study. Actual participants were 420 (84%). Among 81 non participants, 33 (41%) refused to participate themselves. Non participation of the remaining 48 was decided by their parents.

No statistically significant differences were observed between participants and non-participants in terms of age and sex, or with regard to parents' age and sex or their perception of state of health.

Contacts with the cases:

Briefing sessions were held with the parents of all potential participants. In addition, a letter was sent to their homes explaining the rationale of the study, followed by a contact by telephone to arrange the place and date for performing the tests.

Individual written informed consent was obtained from all participants or from at least one parent for children under legal age. Participants were informed of individual and collective results of the study. For the latter purpose, a specific report was prepared and mailed to each participant or family.

	N.	(%)
sex		
male	264	52.7
female	237	47.3
age		
12 years	88	17.6
13 years	70	14.0
14 years	69	13.8
15 years	63	12.6
16 years	67	13.4
17 years	76	15.2
18 years	68	13.6
Total	501	100.0

Table 1. Study population. Sex and age distribution.

Tabella 1. Popolazione in studio. Distribuzione per sesso ed età.

Factor	Left-meaning	Right-meaning
Primary personality factors		
warmth (a)	reserved, impersonal, distant, formal	warm, caring, soft-hearted, and generous
reasoning (b)	less able to solve verbal and numerical problems of an academic nature	more able to solve verbal and numerical problems of an academic nature
emotional stability (c)	reactive, easily upset, temperamental	calm, stable, mature, unruffled
excitability (d)	phlegmatic, undemonstrative, placid	excitable, impatient, demanding
dominance (e)	deferential, modest, submissive	assertive, forceful, competitive
liveliness (f)	serious, quiet, reflective, cautious	carefree, enthusiastic, spontaneous, energetic
rule-consciousness (g)	expedient, non-conforming	rule-conscious, dutiful, scrupulous
social boldness (h)	shy, socially timid, threat-sensitive, easily embarrassed	socially bold, outgoing, gregarious, adventuresome
sensitivity (i)	tough, realistic, logical, unsentimental	emotionally sensitive, intuitive, cultured, sentimental
individualism (j)	vigorous, given to action	restrained, guarded, circumspect
apprehension (o)	self-assured, unworried, complacent	apprehensive, self-doubting, guilt-prone
self-reliance (q2)	group-oriented, affiliative	self-reliant, solitary, individualistic
perfectionism (q3)	tolerates disorder, unexacting, casual, lax	perfectionistic, self-disciplined, goal-oriented
tension (q4)	relaxed, placid, tranquil, patient	tense, driven, high energy, impatient
Secondary personality factors		
anxiety (ax)	tend to be unperturbed by most events and less easily upset than most people	tend to be more easily upset by events; they are more perturbed, both by internal thoughts and feelings as well as by external events
extraversion (ex)	tend to value time spent alone or in solitary pursuits, being generally less inclined to seek out interaction with others	tend to be people-oriented, to seek interaction with others, and to value time spent with others, in social pursuits
tough-mindedness (tm)	tend to be open to feelings, imagination, people, and new ideas	tend to prefer logical, realistic solutions
independence (in)	tend to be agreeable and accommodating to other people and external influences rather than being self-determining	tend to take charge of situations and to influence others rather than be influenced

Table 2. HSPQ. Descriptions of the primary and secondary factor scales.

Tabella 2. HSPQ. Descrizione dei fattori primario e secondario.

Comparison group:

The reference group comprised volunteer high-school students, age ranging 12 to 18 years, who were attending a state-run Junior and Senior public High School (Educación Secundaria Obligatoria - ESO; and Curso de Orientación Universitaria - COU) located in an area of Madrid (Villaverde) where a considerable number of TOS cases had occurred. This assured that the control and the study groups were of a similar socio-economic level. The fact that the schools were state-run assured that all the students lived in proximity of the schools. The school centres facilitated the access to the classrooms. All students attending school on a particular day agreed to participate. Out of 352 students so selected, 25 were excluded from the final analysis since, on being surveyed, they reported living together with a chronically ill person affected by a chronic disease. Their exclusion did not introduce any significant difference in age and sex between study and control group.

Data collection

The Goldberg and Hillier's General Health Questionnaire (GHQ-60) is designed to detect psychological changes. The Spanish version of this test has been validated.^{19,20} It in-

cludes 60 items and collects information on 5 different factors or scales i.e. disease and somatisation, sleep disturbance, social dysfunction, anxiety and depression. Scores were assessed according to the so-called «GHQ» or standard core.²⁰ Each item allows for 4 possible options, ranging from «less than usual» to «much more than usual». The «GHQ scoring system» allots 0 score value to the two lower answer scores and 1 score value to the two higher answer scores (0, 0, 1, 1). Thus, the highest and lowest GHQ scores are respectively 60 and 0. Previously described cut-off points were used for the overall score (11/12)²⁰⁻²¹ and for each factor (disease and somatisation 5/6; sleep disturbance 3/4; social dysfunction 3/4; anxiety 4/5; and depression 3/4).²¹ The overall score on the GHQ is an indication of overall non-specific psychological morbidity. The questionnaire measures recent changes in the measured factors.

In addition, we also used Cattell's personality test,²² a High School Personality Questionnaire (HSPQ), that assesses 14 primary personality factors (warmth, reasoning, emotional stability, excitability, dominance, liveliness, rule consciousness, social boldness, sensitivity, individualism, apprehension, self-reliance, perfectionism and tension) and 4 secondary factors derived from the former (anxiety, extra-

	Exposed n. 420	Unexposed n. 327	OR (95% CI)	P value
GHQ-60 total %	21.0	20.2	1.05 (0.73-1.50)	0.797
disease and somatisation %	5.0	3.1	1.67 (0.78-3.59)	0.187
sleep disturbance %	8.3	4.0	2.20 (1.14-4.22)	0.016
social dysfunction %	4.0	5.2	0.77 (0.39-1.53)	0.454
anxiety %	8.8	10.7	0.80 (0.50-1.31)	0.384
depression %	4.3	4.3	1.00 (0.49-2.04)	0.998

Table 3. Health profiles of the GHQ-60 questionnaire of the children of TOS-affected parents vs controls.

Tabella 3. Profilo sanitario emerso dai 60 questionari GHQ dei figli di persone affette da TOS vs controlli.

version, tough-mindedness and independence). Each factor has a left- (low) and right- (high) meaning score. Left and right-meaning scores indicate trends in the personality factors: mid range scores indicate no trend. For instance a left-meaning score in the EX factor (extroversion) indicates a patient with a tendency to introversion, a right-meaning score in this same EX factor would indicate an extroverted patient and central score would indicate a patient who is neither extroverted nor introverted. Table 2 present a brief description of each of the primary and secondary factors. The Spanish version of this test has also been vali-

dated,²³ and the scales described by the authors were duly followed for score assessment purposes. We decided that, insofar as our results were concerned, no account would be taken of factor B (reasoning), which measures intelligence. The reason for this is that intelligence was not the subject of study. In addition, this is not the best test to measure it. A total of 7 controls were excluded from the final analysis as their questionnaires were incomplete. The time provided for the completion of the questionnaires was the time recommended by the questionnaire's authors and did not differ between study and control groups.

		Exposed n. 420	Unexposed n. 320	OR (95% CI)	P value
factor A warmth	LM: reserved	10.7	10.9	0.98 (0.61-1.56)	0.923
	RM: warm	15.7	11.3	1.47 (0.95-2.27)	0.081
factor C emotional stability	LM: reactive	9.0	6.3	1.49 (0.85-2.62)	0.161
	RM: emotionally stable	21.4	17.8	1.26 (0.87-1.82)	0.222
factor D excitability	LM: phlegmatic	25.7	27.2	0.93 (0.67-1.29)	0.652
	RM: excitable	7.1	8.1	0.87 (0.50-1.50)	0.617
factor E dominance	LM: deferential	5.7	4.4	1.33 (0.67-2.60)	0.413
	RM: dominant	26.2	26.9	0.97 (0.70-1.34)	0.834
factor F liveliness	LM: serious	18.6	18.1	1.03 (0.71-1.50)	0.877
	RM: lively	13.1	12.5	1.06 (0.67-1.63)	0.810
factor G rule-consciousness	LM: expedient	22.9	19.1	1.26 (0.88-1.80)	0.211
	RM: rule-conscious	10.5	8.4	1.27 (0.77-2.10)	0.351
factor H social boldness	LM: shy	5.2	3.1	1.71 (0.80-3.67)	0.161
	RM: socially bold	24.0	26.9	0.86 (0.62-1.20)	0.381
factor I sensitivity	LM: utilitarian	9.8	9.4	1.05 (0.64-1.72)	0.859
	RM: sensitive	9.5	10.3	0.92 (0.56-1.49)	0.722
factor J individualism	LM: vigorous	10.2	8.1	1.29 (0.77-2.15)	0.327
	RM: restrained	14.5	17.8	0.78 (0.53-1.16)	0.226
factor O apprehension	LM: self-assured	29.5	25.3	1.24 (0.89-1.72)	0.205
	RM: apprehensive	6.4	6.3	1.03 (0.57-1.87)	0.921
factor Q2 self-reliance	LM: group-oriented	13.1	9.1	1.51 (0.94-2.43)	0.087
	RM: self-reliant	8.8	9.4	0.93 (0.56-1.55)	0.791
factor Q3 perfectionism	LM: tolerates disorder	6.0	8.8	0.66 (0.38-1.16)	0.144
	RM: perfectionistic	16.9	17.5	0.96 (0.65-1.41)	0.832
factor Q4 tension	LM: relaxed	34.5	35.0	0.98 (0.72-1.33)	0.893
	RM: tense	3.3	3.1	1.07 (0.47-2.44)	0.874

Table 4. Health profiles of the HSPQ questionnaire of the children of TOS-affected parents vs controls. Primary personality factors.

Tabella 4. Profilo sanitario emerso dai questionari HSPQ dei figli di persone affette da TOS vs controlli. Fattori primari di personalità.

		Exposed n. 420	Unexposed n. 320	OR (95% CI)	P value
factor AX anxiety	LM: low anxiety	16.9	16.3	1.05 (0.71-1.55)	0.813
	RM: high anxiety	6.7	6.9	0.97 (0.54-1.73)	0.911
factor EX extraversion	LM: introverted	5.7	6.9	0.82 (0.45-1.49)	0.517
	RM: extraverted	12.4	9.1	1.42 (0.88-2.29)	0.152
factor TM tough-mindedness	LM: receptive	19.3	20.9	0.90 (0.63-1.30)	0.578
	RM: tough-minded	0.7	1.9	0.38 (0.09-1.52)	0.154
factor IN independence	LM: accommodating	2.9	1.9	1.54 (0.57-4.15)	0.390
	RM: independent	11.0	14.4	0.73 (0.47-1.14)	0.162

Table 5. Health profiles of the HSPQ questionnaire of the children of TOS-affected parents vs controls. Secondary personality factors.

Tabella 5. Profilo sanitario emerso dai questionari HSPQ dei figli di persone affette da TOS vs controlli. Fattori secondari di personalità.

Males		Exposed n. 221	Unexposed n. 147	OR (95% CI)	P value
factor A warmth	RM: warm	23.1	14.3	1.80 (1.03-3.15)	0.037
factor J individualism	RM: restrained	10.0	19.0	0.47 (0.26-0.86)	0.013
Females		Exposed n. 199	Unexposed n. 173	OR (95% CI)	P value
factor H social boldness	LM: shy	6.5	1.7	3.96 (1.11-14.14)	0.023
factor Q2 self-reliance	LM: group-oriented	10.6	7.8	2.43 (1.05-5.64)	0.033

Table 6. Health profiles of the HSPQ questionnaire of the children of TOS-affected parents vs controls. Primary personality factors. Results by gender that were statistically significant.

Tabella 6. Profilo sanitario emerso dai questionari HSPQ dei figli di persone affette da TOS vs controlli. Fattori primari di personalità per genere risultati statisticamente significativi.

Data analysis

The information gathered in the questionnaires was stored in an ad hoc database. Results were analysed using the SPSS 14.0 statistical software program. Simple odd ratios and their 95% confidence intervals were calculated for all the variables which were analyzed. The Chi-square test was used for comparisons of categorical variables: when this test was not valid, Fisher's exact test was used. Differences were established to be statistically significant at a value of $p < 0.05$.

Results

Table 3 reports the proportion of children exhibiting high scores for factors considered in the GHQ-60 questionnaire, as well as the corresponding odd ratios and their 95% confidence intervals. Comparison of the two groups displayed no significant differences, except in the case of the sleep disturbance scale ($p = 0.016$). However, statistical significance disappeared in sex-specific analyses.

As for the HSPQ questionnaire, tables 4 and 5 report results for the 13 primary factors and for the 4 secondary factors, respectively. No statistically significant differences between the two groups were observed for any of the factors.

Results of separate analyses by sex are reported in table 6. In males, exposed children registered a significantly greater percentage of right-meaning score for factor A (warm) and a significantly lower percentage of right-meaning score for factor J (restrained).

Among females, significantly higher percentages of left-meaning scores were detected among exposed children for factors H (shy) and factor Q₂ (group oriented).

Insofar as secondary factors were concerned, no significant differences were observed in either sex.

Discussion

Participation in this study was satisfactory and selection bias is unlikely. The study was limited to residents in Madrid City, where 26% TOS cases had been recorded at the time of the outbreak. The comparison group was chosen in one school in a Madrid area with socioeconomic characteristics similar to the cohort of TOS. Selection bias within the study group is unlikely. The 84% participants and the 16% non participants did not differ in terms of age or sex. In addition, we analysed the parents' self perceived state of health periodically recorded by our research group:⁴ there were no differences between participants and non participants with regard to this variable. Thus, we can consider our results as reasonably valid.

GHQ-60

A significantly higher proportion of children in the study group reported sleep disturbance. However statistical significance was lost in sex-specific analyses. A reasonable explanation of this observation is that the questionnaire was offered to children of the study group in the proximity of school examina-

tions. Indeed, in reviewing the questionnaires, we found out that 12 children with a high score for sleep disturbances had undergone school examinations in the preceding days. The data for the controls were collected during a school period free of examinations. If these 12 cases are excluded from the analyses, the results cease to be significant ($p=0.350$).

HSPQ

There were no significant differences between study group and control group in terms of primary or secondary factors.

However, differences regarding primary factors were detected in analyses carried out separately in each sex. Among males of the study group, there was a higher proportion of right-meaning scores for factor A, which indicates a warm, outgoing and sociable character. This group also exhibited a significant low percentage of right meaning score of factor J, expressing that are less restrained and less self-doubting and individualistic than the comparison group: this exposed group showed itself to be much more extroverted (15.8% vs 9.5%) ($p=0.081$), (data not shown).

Females of the study group showed a relatively high proportion of the left-meaning of factor H, indicating shyness and of factor Q₂, indicating that they are more sociable, with easy union to the group and ready for comradeship. These differences between study and control groups might reflect educational, behavioural and lifestyle factors, etc. In any case, our overall findings did not detect any specific personality which could be linked to life close chronically ill patients. Among children of TOS victims, we did not observe factors, such as anxiety, depression, excitability and introversion, which could have been expected on the basis of our initial hypothesis. Through another database kept at our Centre⁴ we have been able to characterize parents of the study group on the basis of the self-perceived state of health. Fathers of mothers of children included in the present study reporting good, fair and poor self-perceived state of health were respectively 33.4%, 55.4% and 11.2%. Separate analyses limited to the 47 children born from parents belonging to the latter group did not detect any difference with the control group regarding replies to either GHQ-60 or the HSPQ, (data not shown). In conclusion, there may well be other factors that might reflect on our hypothesis, such as the way in which affected parents have led their children to experience the disease as being very important. Indeed, in informal interviews maintained with parents over the course of the study, we were able to confirm that, in general, they consciously strove to make no expression or allusion to their disease or its symptoms, except in those cases in which their state of health was obviously poor.

Conflict of interests: none

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