

Cognitive Performance, Physical Pain and Psychological Distress in Women with Fibromyalgia During The COVID-19 Pandemic in Chile: A Case-Control Study

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Abstract

Fibromyalgia (FMS) is a chronic condition that encompasses widespread pain associated with cognitive impairment and significant emotional distress related to functional disability that affects mainly women. However, the mechanisms underlying the origin of the cognitive impairments and how the current COVID-19 pandemic impacts remain elusive. This study aimed to determine whether there is an association between cognitive performance in executive functions, physical pain, and psychological distress caused by the pandemic in a group of Chilean women with FMS using a novel online protocol of neuropsychological evaluation. We found that women with FMS present cognitive impairment predominantly explained by pain and anxiety symptoms, which are associated with the difficulties experienced from the COVID-19 pandemic. These results point out the importance of considering a broader perspective for treatment, including anxiety symptoms and the psychological distress caused by the pandemic as a therapeutic target for cognitive impairments.

Introduction

Fibromyalgia (FMS) is a chronic syndrome characterized by complex symptomatology, the core of which is generalized and persistent musculoskeletal pain that also comprises fatigue, sleep disturbances, morning joint stiffness, depression, and anxiety^{1,2}. This syndrome is one of the most common causes of widespread chronic pain and is a common condition in the general population^{3,4}. The worldwide prevalence of FMS is between 2% and 5%, regardless of the territory, and it mainly affects women⁵. Despite lacking studies in Chile, a similar prevalence is estimated, with predominance in women as well⁶. On the other hand, FMS has been associated with the suffering of physical and emotional trauma and a history of post-traumatic stress^{7,8}. Its impact on quality-of-life compromises physical, psychological, and social domains^{9,10}, including performing adequately in the work context¹¹.

Additionally, cognitive impairments in FMS patients have been reported, such as forgetfulness, concentration difficulties and/or mental slowness. These impairments are known as fibrofog and are considered among the most severe symptoms of the disease^{12,13}. Several affected cognitive functions have been identified in a variety of studies, such as attention and memory^{14,15}, and cognitive processing speed¹⁵. Furthermore, executive function impairment has also been confirmed, including planning¹⁶, abstract thinking¹⁷, and cognitive flexibility¹⁸. In this line, a recent meta-analysis that included 37 FMS case studies and controls concluded a decrease in the performance of memory, attention, processing speed, and mainly executive functions¹⁹.

The mechanisms underlying the origin of the aforementioned impairments are not well understood yet. However, the Neurocognitive Model of Attention to Pain might provide a theoretical framework to understand and test whether the pain interferes with attention processes. According to this model, any cognitive dysfunction in the context of chronic pain is the result of the interference between attention focused on both the peripheral input (pain) and the goal-directed activity^{20,21}. In other words, pain and

high interoceptive monitoring might lead to reduced attention performance in cognitively demanding tasks or activities, in turn increasing the susceptibility to distraction and slowing down the information processing, interfering with cognitive function ²¹.

Additionally, there is a susceptibility to suffering from anxiety and depressive disorders in patients with FMS ^{22,23}, which can increase the reported cognitive deficits ²⁴. In this line, there is a crucial link between cognitive decline, pain, and psychological distress.

Currently, the emergency due to COVID-19 has seriously impacted the population's mental health ²⁵. In this context, it has been reported that FMS patients who experience chronic pain present a higher risk of increased psychological distress ²⁶. However, how the pandemic and its potential effect on the mental health of FMS patients is related to their cognitive performance remains elusive. Besides, there is a lack of these types of studies on the Latin American population, which might be of particular interest considering both the socio-cultural aspects and that the response to the pandemic has been slower and with fewer resources than developed countries ²⁷.

Here we aimed to determine whether there is a relationship between cognitive performance, physical pain, and psychological distress in Chilean women with FMS during the COVID-19 pandemic using a novel online protocol of neuropsychological evaluation. In order to do this, a group of FMS patients and controls were contacted and evaluated using online platforms in an asynchronous way first, where they answered a sociodemographic scale, pain level rating, psychological distress, and executive functions assessment using behavioral scales. Afterward, they were contacted to conduct a synchronic online evaluation with trained neuropsychologists using traditional virtually adapted cognitive tests (Fig. 1).

We hypothesize that FMS patients present higher levels of psychological distress due to the pandemic and conjointly with physical pain; in agreement with the Neurocognitive Model of Attention to Pain, it will negatively impact their cognitive functions. Our results will contribute to the scientific body of knowledge and the clinical field since they may impact the development of clinical guidelines and health personnel training. Likewise, it is possible to promote and develop public policies that benefit patients with FMS, considering that there is still an under-consideration of these cases ²⁸.

Results

We found no significant differences between groups in sociodemographic characteristics. However, there were higher scores in depressive symptoms, panic attacks, and pharmacological treatment in the clinical dimension of our sample. Table 1 shows a summary of the sociodemographic and clinical descriptive statistics.

Table 1
Clinical and Sociodemographic Characteristics of FMS and Control Groups ^a

	FMS		Control		p	d / V
	N = 51		N = 19			
Characteristic	M / N	SD / %	M / N	SD / %		
Age	44.05	8.71	40.63	9.79	0.16	-.38
Education (in years)	13.74	4.68	13.89	5.21	0.90	-.03
Time since diagnosis						
Less than a year	2	2.85	-	-		
1 year	4	5.71	-	-		
2 years	13	18.57	-	-		
3 years	6	8.57	-	-		
More than 3 years	26	37.14	-	-		
Marital status						
Single	13	25.49	10	52.63	0.08	.34
Married	15	29.41	7	36.84		
Divorced / Separated	14	27.45	1	5.26		
Widowed	1	1.96	0	0.00		
Cohabiting	8	15.68	1	5.26		
Occupation						
Unemployed	9	17.64	2	10.52	0.26	.27
Retired	6	11.76	0	0.00		
Housework	12	23.52	3	15.78		
Active w/ medical license	7	13.72	3	15.78		
Active w/o medical license	17	33.33	11	57.89		
House and family						
Single	2	3.92	1	5.26	0.84	.14

^ap<0.05*, p < 0.001**. M = Mean. SD = Standard Deviation. d = Cohen's d. V = Cramer's V. FMS = Fibromyalgia Syndrome, CVA = cerebrovascular accident, OCD = Obsessive Compulsive Disorder, PTSD = Posttraumatic Stress Disorder.

	FMS		Control			
	N = 51		N = 19			
w/ partner	3	5.88	1	5.26		
w/ partner and children	17	33.33	9	47.36		
w/ Partner, children, and other	7	13.72	2	10.52		
Other	22	43.13	6	31.57		
Clinical data						
Diabetes (yes)	3	6.00	0	0.00	0.27	.13
CVA (yes)	1	1.42	0	0.00	0.53	.07
Hypertension (yes)	9	17.64	1	5.26	0.18	.15
Thyroid disease (yes)	15	29.41	6	31.57	0.86	.02
Depression (yes)	37	72.54	3	15.78	< .001**	.51
Crisis de panic (yes)	21	41.17	3	15.78	0.047*	.23
OCD (yes)	4	7.84	1	5.26	0.70	.04
Agoraphobia (yes)	4	9.80	0	0.00	0.15	.16
PTSD (yes)	10	19.60	1	5.26	0.14	.17
Drug consumption (yes)	46	90.19	9	47.36	< .001**	.46
^a p<0.05*, p < 0.001**. M = Mean. SD = Standard Deviation. d = Cohen´s d. V = Cramer´s V. FMS = Fibromyalgia Syndrome, CVA = cerebrovascular accident, OCD = Obsessive Compulsive Disorder, PTSD = Posttraumatic Stress Disorder.						

To analyze physical pain differences, difficulties due to the pandemic, mood, and their impact in FMS, we performed statistical comparisons showing that FMS patients exhibited higher levels of generalized physical pain, greater difficulties due to the pandemic in general and in several specific dimensions: mood, pain, financial, family, health, food supply. Table 2 summarizes the statistical comparisons in physical pain, difficulties due to the pandemic, mood, and their impact on FMS.

Table 2

Physical pain, Difficulties due to the Pandemic, Mood, and their impact on FMS^a.

	SFM		Control		p	d
	N = 51		N = 19			
Physical pain	M	DE	M	DE		
Head	6.02	3.21	2.94	3.00	< .001**	-.97
Nape	6.37	3.58	1.15	2.34	< .001**	-1.58
Behind the neck	7.31	2.90	1.78	2.34	< .001**	-1.94
Face	3.45	3.34	0.36	0.95	< .001**	-1.05
Neck	6.68	2.89	2.42	2.43	< .001**	-1.59
Shoulders	7.49	2.83	2.26	3.01	< .001**	-1.81
High back	7.49	2.88	2.52	3.00	< .001**	-1.70
Middle back	6.60	2.94	2.05	2.91	< .001**	-1.55
Lower back	7.39	2.96	2.78	2.99	< .001**	-1.54
Shoulders	7.49	2.83	2.26	3.01	< .001**	-1.81
Hands	6.90	3.30	1.05	2.24	< .001**	-1.91
Wrist	6.60	3.00	1.05	1.47	< .001**	-2.06
Chest	3.82	3.63	0.57	1.46	< .001**	-1.01
Ribs	3.76	3.45	0.52	1.61	< .001**	-1.05
Hips	6.54	3.44	1.57	2.52	< .001**	-1.54
Thighs	6.17	3.50	0.78	2.14	< .001**	-1.68
Buttocks	4.94	3.33	1.26	2.62	< .001**	-1.16
Knees	6.45	3.31	1.89	2.97	< .001**	-1.41
Tibias	5.17	3.76	0.26	0.80	< .001**	-1.50
Shinbone	5.35	3.83	0.26	0.80	< .001**	-1.53
Feet	5.76	3.49	0.73	1.24	< .001**	-1.64
Total pain	113.64	45.36	25.89	25.43	< .001**	-2.13
Difficulties due to the Pandemic						

^ap<0.05*, p < 0.001**. M = Mean. SD = Standard Deviation. d = Cohen's d. HAD = Hospital Anxiety and Depression Scale.

	SFM		Control			
	N = 51		N = 19			
Mood	1.66	0.79	0.94	0.84	< .001**	- .89
Pain	2.03	0.82	1.00	0.81	< .001**	-2.13
Financial	1.39	1.06	0.63	0.95	0.008*	- .73
Family	1.05	0.88	0.57	0.69	0.036*	- .57
Health	1.66	0.90	0.52	0.61	< .001**	-1.35
Feeding	0.86	0.84	0.21	0.53	< .003*	- .83
Fear of COVID-19	1.52	1.02	1.15	0.69	0.156	- .38
Fear of dying from COVID-19	0.88	0.42	0.42	0.69	0.072	- .49
Total COVID-19 difficulty	11.09	4.57	5.47	3.30	< .001**	-1.31
Mood Status						
HAD Depression	12.25	2.98	11.68	3.00	0.480	- .19
HAD Anxiety	12.76	4.30	7.31	4.02	< .001**	-1.28
^a p<0.05*, p < 0.001**. M = Mean. SD = Standard Deviation. d = Cohen´s d. HAD = Hospital Anxiety and Depression Scale.						

Cognitive performance was evaluated in different domains. Interestingly, we found no differences in memory performance and phonological fluency. However, the executive functions exhibited impairment in the FMS group. Specifically, the semantic fluency and the attention measured using the Symbol-Digit test. Additionally, the executive functions evaluated using the self-rating Dysexecutive Questionnaire (DEX-Sp) also showed lower performance in all dimensions: impulsivity and disorganization (Fig. 3). Table 3 shows the statistical comparisons between groups in cognitive performance.

Table 3

Cognitive performance and dysexecutive symptoms standardized by age and education (z-score) ^a.

	FMS		Control		p	d
	N = 51		N = 19			
Memory	M	DE	M	DE		
HVLT Learning	-0.51	0.93	-0.28	0.64	0.330	.42
HVLT Recall	-0.38	0.94	-0.02	1.02	0.171	.37
Language						
Phonological Fluency	0.86	1.20	1.11	1.17	0.442	.20
Semantic Fluency	-0.00	1.14	1.19	0.65	< .001**	1.15
Executive Functions						
SDMT	-1.45	0.70	-0.67	1.16	< .001**	.91
Digit Span Test Forward	-1.28	0.82	-0.92	0.63	0.084	.47
Digit Span Test Inverse	-0.57	0.89	-0.32	0.83	0.289	.28
DEX Disorganization	2.34	1.53	-0.01	0.87	< .001**	-1.70
DEX Impulsivity	1.47	1.41	-0.08	1.17	< .001**	-1.14
DEX Dysexecution total	2.14	1.55	-0.05	1.06	< .001**	-1.52
^a p<0.05*, p < 0.001**. M = Mean. SD = Standard Deviation. d = Cohen's d. FMS = Fibromyalgia Syndrome. HVLT = Hopkins Verbal Learning Test. SDMT = Symbol Digits Modalities Test. DEX = Dysexecutive Questionnaire.						

To determine whether there is a relationship between time since diagnosis, anxiety score, depression score, the impact of FMS, pain rating, difficulties due to COVID-19, DEX-sp, SDMT, and FVS, we performed Pearson's r correlations between these parameters. We found various correlations (Table 4).

Table 4

Correlations between Time Since FMS Diagnosis, Anxiety, Depression, Impact on FMS, Pain, Difficulties due to the Pandemic, DEX, SDMT, and SVFT^a.

	DEX total	SDMT Z score	FVS Z score	Tiempo Dg. FMS
Time since FMS diagnosis	.59**	-.34**	-.44**	-
HAD Anxiety	.63**	-.28*	-.33*	.61**
HAD Depression	.05	.15	.06	.05
Total Pain	.67**	-.38**	-.43**	.67**
Total COVID-19 difficulty	.55**	-.29*	-.14	.55**

^ap<0.05*, p < 0.001**. HAD = Hospital Anxiety and Depression Scale. SDMT = Symbol Digits Modalities Test. DEX = Disexecutive Questionnaire. SVFT = Semantic Verbal Fluency Test.

Afterward, in order to determine the effect of the difficulties due to the pandemic, physical pain, and psychological distress over cognitive performance, we performed a stepwise linear regression. Importantly, we found that the predictor variables have a significant effect on cognitive performance (Table 5).

Table 5

Stepwise Linear Regression. Pain, Anxiety, and Fibromyalgia explaining cognitive performance ^a.

Total sample (N = 70)					
SDMT Z-score					
	β	t	p	R ²	ΔR^2
Model 1					
Total Pain	-.38	-3.44	< .001**	.13	-
DEX Total Z-score					
	β	t	p	R ²	ΔR^2
Model 1					
HAD Anxiety	.70	8.07	< .001**	.48	-
Model 2					
HAD Anxiety	.55	5.86	< .001**	.53	.06
Fibromyalgia	.28	3.04	< .003*		
SVFT Z-score					
	β	t	p	R ²	ΔR^2
Model 1					
Fibromyalgia	-.46	-4.29	< .001**	.20	-

^ap<0.05*, p < 0.001**. HAD = Hospital Anxiety and Depression Scale. SDMT = Symbol Digits Modalities Test. DEX = Disexecutive Questionnaire. SVFT = Semantic Verbal Fluency Test.

Discussion

In this study, the cognitive performance of FMS patients was evaluated to determine whether cognitive functions were affected by physical pain and/or psychological distress due to the pandemic. To address this question, we designed a novel online protocol that can be reproduced for clinical purposes. We found impairment in executive functions or high-order cognitive functions for the FMS group, where the physical pain explained part of this significant result. This finding was in line with our predictions since it has previously been reported that physical pain reduces attention capacity, affecting overall cognitive performance ²⁰, which agrees with the Neurocognitive Model of Attention to Pain ²⁹.

Furthermore, FMS patients exhibited semantic fluency impairment suggesting semantic access difficulties, which involves executive action to retrieve information from long-term memory ³⁰. This result

is in line with studies showing deficits in this area ³¹. Additionally, we have found for the first time an association between dysexecutive symptoms, pain, time since diagnosis of FMS, difficulties due to the pandemic, and anxiety symptoms.

This study has some limitations. Firstly, we evaluated only women from an urban context; thus, these findings are not extrapolatable to other groups, such as men with FMS or people from rural zones. Secondly, Results involving the difficulties due to pandemic evaluation have to be taken with precautions since these were conducted without previous psychometric properties data of this instrument, which might affect the level of reliability of this particular finding. Finally, we strongly recommend for future research including other social groups (for instance, men and rural groups) to strengthen the results and subsequent interpretations.

Conclusions

Our results show that Chilean women with Fibromyalgia exhibit subjective and objective cognitive impairments, predominantly in executive functions or high cognitive demanding tasks. These impairments are mainly explained by pain and anxiety symptoms that they suffer, which are positively associated with the difficulties experienced from the COVID-19 pandemic. Additionally, these results express the relevance of considering the treatment of pain and anxiety symptoms as a therapeutic target for cognitive impairments and the effect of the pandemic on their daily functioning.

Methods

This study is case-control, cross-sectional, descriptive, and non-experimental. The sampling technique was non-probabilistic. All the procedures were carried out remotely in tele-neuropsychology format ³² due to the health emergency caused by COVID-19 pandemic. The ethics committee of the Universidad Santo Tomás approved procedures, and all methods were carried out in accordance with the relevant guidelines and regulations.

Subjects

Data was collected from seventy right-handed and Chilean adult women. From the total sample, there was a group of fifty women diagnosed with FMS (mean age = 44.05, SD = 8.71) and nineteen healthy women as a paired-match (sex, age, nationality, demographic similarities) control group (mean age = 40.63, SD = 9.79). The sample size followed the gold standard reported in the meta-analysis by Bell et al. ¹⁹. Patients with FMS were diagnosed by a specialist following the 1990 American College of Rheumatology criteria for FMS ²⁸ and were recruited from Fibromyalgia Associations located in distributed regions of Chile, while participants belonging to the control group were recruited based on demographic similarities with patients. Exclusion criteria for the control group were neurological or psychiatric disorders and medical background of severe somatic diseases. All participants signed an informed consent form before the beginning of the study.

Instruments

- Sociodemographic Questionnaire: We designed an open-ended and multiple options questionnaire instrument that measures general demographic characteristics (age, medications, illnesses, schooling, history of mental disorders, medical background, among other aspects). Additionally, in this questionnaire a likert scale was included to evaluate difficulties due to the pandemic (mood, physical pain, financial problems, family, health, fear of being infected, food, and fear of dying).
- Hospital Anxiety and Depression Scale (HAD) ³³: The HAD is a self-assessment scale that detects states of depression and anxiety in patients with different chronic conditions, assessing the cognitive and behavioral symptoms of anxiety and depression. It is composed of two subscales (Depression and Anxiety), each of them has 7 items. Each score varies between 0 to 21. The response options range from: absence / minimum presence = 0 to maximum presence = 3. The higher the score obtained, the greater the intensity or severity of the symptoms. This scale has been validated in patients with FMS from a Spanish population and has good psychometric properties ³³.
- Disexecutive Questionnaire (DEX-Sp) ³⁴: The DEX-sp is a brief and easy to complete Likert-type self-report test with twenty items, and five response options between 'never' (0 points) and 'very often' (4 points) used to estimate executive dysfunction. This test assesses abstract thinking, planning, insight, temporal sequencing, impulse control, response inhibition, decision-making, as well as the presence of fables, impulsivity, euphoria, apathy, aggressiveness, restlessness motor, superficial affective responses, perseverance, distractibility, and disregard for social rules ³⁵. This scale presents good psychometric properties and has been validated in the Spanish-speaking population ³⁴.

Visual Analog Scale of Pain (VAS): The VAS is a subjective measure of acute and chronic pain intensity. Scores are recorded by making a handwritten mark on a 10-cm line representing a continuum between "no pain" and "the worst pain imaginable." The VAS is a reliable and valid scale for many patient populations ³⁶. A value lower than 4 on the VAS means mild or mild-moderate pain, while a value between 4 and 6 implies moderate-severe pain. A value higher than 6 implies the presence of very intense pain.

Cognitive variables

- Hopkins Verbal Learning Test (HVLT) ³⁷: The HVLT is a verbal memory test consisting of a 12-item word list composed of 3 semantic categories, which subjects should recall after the list has been read to them. This procedure is repeated three times. 25 minutes later, subjects are asked to recall the list of words again. Then, for a yes/no recognition, a list of 24 words is read, which consists of the 12 original/target words, 6 distractors from the same semantic categories and 6 unrelated distractors. This test provides scores for a learning curve, long-term memory, and recognition/discrimination. The HVLT is a valid instrument in the Latin American Spanish-speaking adult population with good psychometric properties ³⁷.

- Symbol Digit Modalities Test (SDMT): The SDMT measures sustained attention and speed of information processing³⁸ consisting of nine digits paired with symbols underneath. Participants are asked to provide the corresponding number for each symbol for 90 s. The SDMT is a valid instrument in the Latin American Spanish-speaking adult population with good psychometric properties³⁹.

F-A-S Test: These tests evaluate executive functions since they demand participants to be flexible, organize information, provide effort, and control inhibition when it is needed⁴⁰. In order to evaluate these complex cognitive functions, we used the phonological and semantic fluency tasks, which both have been validated and normalized in the Latin American Spanish-speaking adult population with good psychometric properties⁴⁰.

- Phonological Verbal Fluency: This test aims to ask participants to create as many words as possible, beginning with a specific letter (F, A, S) for 60 seconds. If a participant does not respond within 10 seconds, the examiner gives prompts⁴⁰.

- Semantic Verbal Fluency: This test demands participants to produce items that belong to a given category (e.g., animals) within 60 seconds. The participants are also provided with prompts for this test when they do not respond within 10 seconds⁴⁰.

Digit Span tests: These are verbal tasks, with stimuli presented auditorily. These tests aim to assess attention (Digit Span Forward) and working memory capacity (Digit Span Reverse)⁴¹.

- Digit Span Forward: In this test, the experimenter says a sequence of digits (one digit per second); at the end, the participant is asked to repeat the digits back to the experimenter in the same order that was given. The task begins with a few digit sequences, and then the number of digits increases⁴¹.

- Digit Span Reverse: This version of the test has the same structure as the Digit Span Forward. The difference is that the participant is asked to repeat the digits in reverse order which requires manipulation of information, thus working memory function⁴¹.

Procedure

After the ethics committee of the Universidad Santo Tomás approved the research project, this was formally presented at the Fibromyalgia Association of Chile. Women diagnosed with FMS members of the association along the country were voluntarily recruited. Afterward, patients were contacted to confirm computer/tablet or smartphone availability with an internet connection. Subsequently, they received an online form that included a brief description of the research, informed consent, sociodemographic questionnaire, medical history, and the instruments: difficulties due to the pandemic, the DEX-Sp, VAS, and HAD scales.

After the first data collection, the second part of the process was to conduct the online neurocognitive protocol consisting of the HVLTL, SDMT, F-A-S, and Digit Span tests. The evaluation protocol lasted

approximately 30 minutes and was applied through the Whereby platform from March to May 2021.

Later, the control group with similar characteristics as the FMS patient group was recruited. The control group was evaluated following the same procedure aforementioned. Finally, once all data were collected, statistical analyses were performed (Figure 2).

Data Analysis

The student's t-test was used to compare variables between groups. Additionally, Cohen's d test was performed to estimate the size effect. Moreover, we conducted the Chi square test and the Cramer's V test for nominal variables, respectively. To determine the association level between variables, we used the Pearson r correlation test. Furthermore, in order to determine the effect of pandemic difficulties, physical pain, and psychological distress on cognitive performance, a stepwise linear regression was used, including 5000 samples bootstrap. All statistical analyzes were performed using the SPSS 25 statistical software synchronized with JASP, considering a significance threshold of $p < 0.05$.

Declarations

Data availability

The data of the current study are available from the authors upon reasonable request.

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Author Contributions

M.R.-H.: Conceived the project, evaluation of subjects, analyzed data, prepared figures, wrote manuscript, revised and commented the manuscript. I.T.-R.: Analyzed data, prepared figures, discussed data. R.A.-C.: Evaluation of subjects, analyzed data, wrote manuscript, revised and commented the manuscript. D.P.: Evaluation of subjects, wrote manuscript, discussed data, prepared figures, revised and commented manuscript. M.S.-A.: Analyzed data, prepared figures, discussed data. N.L.: Analyzed data, prepared figures, discussed data. M.D.-S.: Analyzed data, prepared figures, wrote manuscript, discussed data, revised and commented the manuscript.

Competing interests

The authors declare that they have no competing interests.

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Figures

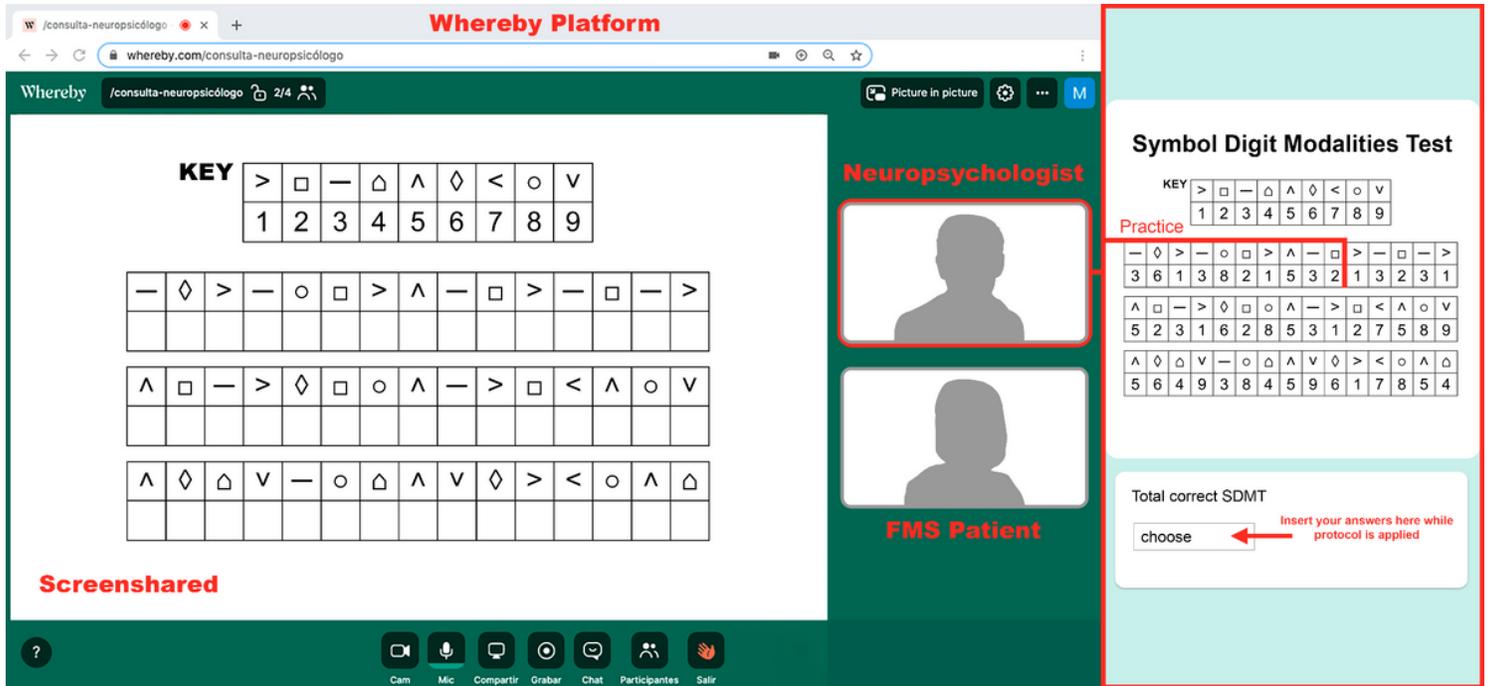


Figure 1

Representative neuropsychological online protocol. A trained neuropsychologist explained and guided the cognitive evaluation to FMS and control groups through the Whereby platform.

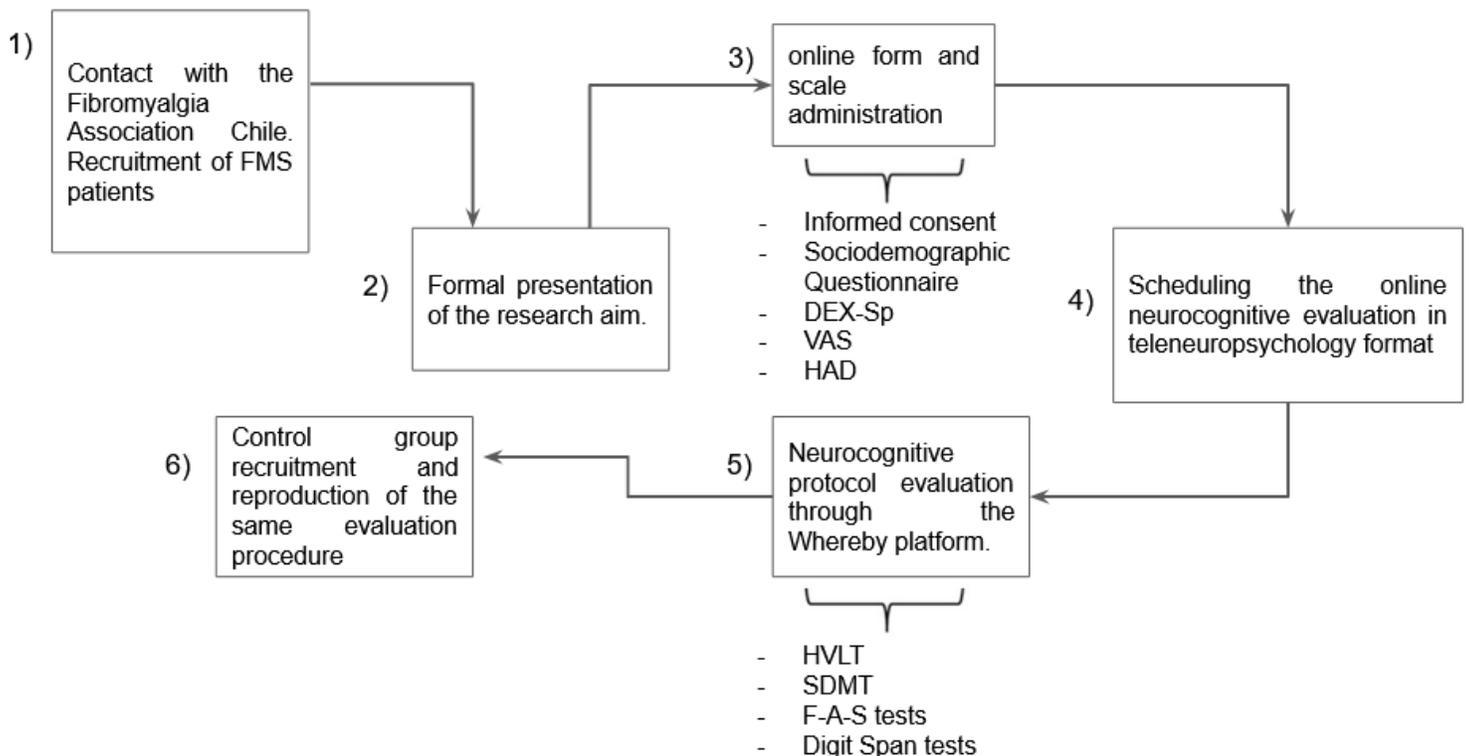


Figure 2

Scheme of the Procedure.

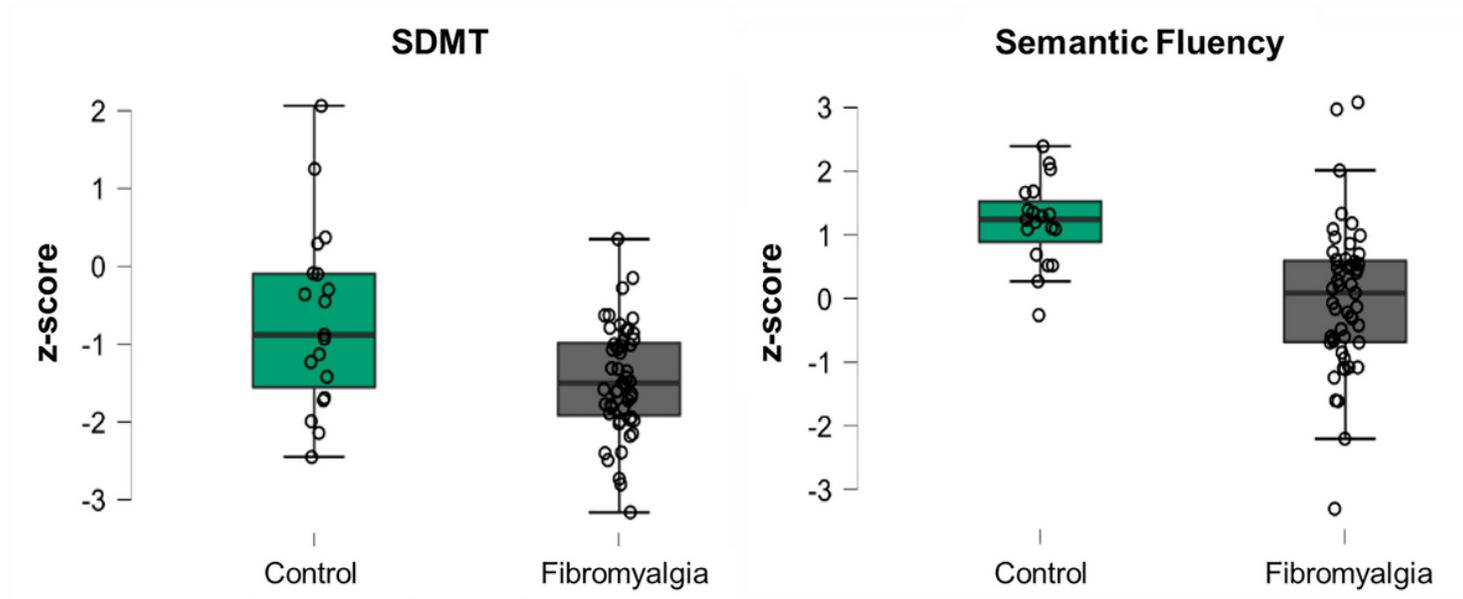


Figure 3

Whisker and boxplots. Cognitive performance in Symbol Digit Modalities Test (SDMT) and Semantic Fluency test. The FMS group exhibited a significant decrease in their executive functioning performance in both measurements: SDMT ($<.001^{**}$) and Semantic Fluency Test ($<.001^{**}$).