CHRONIC FATIGUE SYNDROME KNOWLEDGE, ATTITUDES, BELIEFS, AND PERCEPTIONS AMONG FAMILY MEDICINE TRAINEES, AL KHOBAR, SAUDI ARABIA, 2016

Medicine

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ABSTRACT

Background : Chronic fatigue syndrome (CFS) places considerable burdens on patients and society. This study assesses family physicians' awareness of CFS.

Methods: Between November 11 and December 29, 2016, a cross-sectional study was performed with trainees of the Ministry of Health Family Medicine Post-Graduate Program in the Eastern Province of Saudi Arabia. All trainees were invited to participate through a validated, piloted internet-based questionnaire.

Results: Seventy trainees completed the 19-item questionnaire (response rate=95.89%). The construct validity achieved an "excellent" rating, and the reliability had a Cronbach's alpha of 0.61. The mean scores were as follows: Knowledge=81%, Perception= 78.34%, Attitude=69.77%, Belief=77.71%, and Awareness=72.22%. Four (5.7%) trainees had diagnosed CFS. Seventeen trainees (24.3%) disagreed that CFS was a distinct disease, 23 (32.8%) agreed, and 30 (42.9%) were undecided. The female trainees had higher Perception scores than the males (p=0.019).

Conclusions: The overall Awareness score was "moderate", whereas the lowest score was found for Attitude, which involves the conjoining of CFS and depression by the physicians. The trainees were unprepared to diagnose CFS; even trainees who had diagnosed CFS previously did not have a high level of awareness.

BACKGROUND

Chronic fatigue syndrome (CFS) is defined as "a disorder characterized by persistent and unexplained fatigue that results in a severe impairment in daily functioning". Most patients with CFS describe additional symptoms, such as muscular pain, cognitive impairment, and unrefreshing sleep. Other symptoms may include headache, sore throat, lymph node tenderness, muscular and joint pain, fever, sleeping troubles, psychiatric disorders, abdominal pain, and allergies. The Centers for Disease Control and Prevention (CDC) have developed helpful criteria to diagnose CFS[1].

"Myalgic encephalomyelitis" (ME) is a label equivalent to CFS. Additionally, two previous labels were paired in the umbrella label "ME/CFS" to create a third accepted unique term [2]. Other labels include "neurasthenia", "post-viral fatigue syndrome" (PVFS), "chronic fatigue immune dysfunction syndrome" (CFIDS) and "systemic exertion intolerance disease" (SEID)[3].

Chronic fatigue syndrome is a relatively common illness that places a considerable burden on patients and their families, caregivers, and society –[4].

McManimen et al. [5] showed that CFS patients were at higher risk for all-cause and cardiovascular-related mortality and concluded that CFS patients had a lower mean age of death for suicide and cancer than the U.S. population.

A recent observational study in 2017 that involved adolescents who attended specialist CFS services revealed that obesity was prevalent among those patients[6].

Taylor et al. [7]assessed whether a causal relationship existed between depression and CFS in young people. The study suggested that young people developed depression secondary to CFS.

The CFS prevalence is variable worldwide, but the disease affects females three to four times more frequently than males [8]. However, local prevalence estimates in Saudi Arabia were not found during the literature review.

Werker et al. (2013) estimated that the prevalence of adolescents affected with CFS was between 0.11 and 1.29% in Dutch, British, and American populations. Similarly, Johnston et al. (2013) performed a meta-analysis of 14 studies and concluded that the prevalence rates were 4.33% and 1.29% for self-reporting assessment and clinical assessment, respectively[9,10].

Several recent articles described possible psychiatric and organic etiologies of CFS.

Brooks et al. [11] identified several personality traits, including perfectionism and unhelpful beliefs about emotions, that might be prominent prior to CFS development.

Post-exertional fatigue, which is commonly considered a feature of CFS, was shown to be linked to oxidative and nitrosative stress (O&NS) in recent studies. In addition to O&NS, mitochondrial and metabolic abnormalities were linked to striated muscle fatigue and impaired contractility[12].

Although the specific microbial etiology remains unclear, recent evidence suggests that ongoing intestinal dysfunction and microbiota instability might be implicated as an etiology in some CFS cases[13].

Diagnosing CFS is a challenge due to complicating factors related to physicians, patients, and the disease itself. Fatigue is highly prevalent in general practice, and approximately 10% of the patients seeking care in primary care centers describe fatigue as their main issue. Additionally, fatigue and other CFS symptoms are common to many

other illnesses, which can further complicate the issue. The disease has a pattern of remission and relapse, and the symptoms are variable in type, number, and severity. Physicians may not realize that their patients are ill, and no laboratory test or biomarker is available to confirm the diagnosis. These factors have led to a trivial diagnosis rate; for instance, although an estimated 1 to 4 million Americans have CFS, less than 20% have been diagnosed [14-16].

Biomarkers have questionable reliability due to the variability in case definitions used to diagnose CFS. A total of nine usable sets of criteria were identified by Haney et al. [17,18].

Previously, postural orthostatic tachycardia (POTS) was proposed as a possible marker for CFS, but recent research by Roerink et al. [19] concluded that POTS did not have significant diagnostic value.

In 2015, Smith et al. [20] reviewed 35 treatment trials and concluded that only Rintatolimod (an immune modulator), counseling, and graded exercise therapy (GET) trials offered benefits to CFS patients.

Moreover, in 2016, Collatz et al. [21] found no clear evidence to specify a universal pharmacological intervention for CFS treatment.

Although cognitive behavioral therapy (CBT) was considered moderately effective by Rimbaut et al. [22], CBT and GET were shown to be equally effective by Larun et al. [23].

Campagnolo et al. [24] found that neither a modified diet nor nutritional supplements relived CFS symptoms.

Windthorst et al. [25] assessed two treatment modalities [heart rate variability biofeedback (HRV-BF) therapy and GET]. Both modalities were shown to reduce fatigue, but HRV-BF further influenced mental health, whereas GET influenced physical health.

Several studies have investigated the etiology and pathogenesis of CFS. Numerous studies have focused on its prevalence, whereas few studies have aimed to assess the awareness of healthcare providers. Relevant studies were found in a widely spaced pattern, with the oldest published in 1991 and the most recent in 2010. However, none of those studies were performed in the Arab Gulf Cooperation Countries (GCC).

Surveys of Saudi Arabian general practitioners' awareness of CFS were not found in the literature. To measure the prevalence of CFS in Saudi Arabia, knowledgeable, skillful physicians and health teams need to diagnose and manage these cases. This lack is an issue that demands the assessment of our health teams' knowledge, attitudes, beliefs, and perceptions about CFS, which is the aim of the present study. The information gained from this study is expected to form a foundation for the development of CFS educational strategies in Saudi Arabia.

METHODS
Between November 11 and December 29, 2016, a cross-sectional study was performed that included all Board and Diploma trainees of the Ministry of Health Family Medicine Post-Graduate Program in the Eastern Province in Saudi Arabia (the Saudi Board of Family Medicine program lasts four years, and the Diploma lasts two years). Ninety-four trainees were enrolled in the training program at the time of the study. A pilot study was conducted with 32 participants. A total of 21 trainees from the target population were excluded from the current study, and the remaining 11 participants were from a different Family Medicine training program in a different region.

A total of 73 trainees were invited to participate in the study via a mobile messaging application with a link to the self-administered electronic questionnaire.

Research Tool
The anonymous electronic self-administered questionnaire involved

demographic data in addition to 23 questions that were divided into the Knowledge, Attitude, Belief and Perception dimensions. The total score of the four dimensions constituted the Total Awareness dimension.

A 5-point Likert Scale constituted the dependent variable of the current study and ranged from "strongly disagree" to "strongly agree" (1=strongly disagree, 2=disagree, 3=undecided, 4=agree, and 5=strongly agree). The resultant scores were transformed into percentages so that each point on the Likert Scale constituted 20%. At the discretion of the authors, scores below 60% were considered "low", scores 60% to less than 80% were considered "moderate", and scores greater than 80% were considered "high".

Construct Validity and Reliability
The questionnaire was constructed through review of the relevant recent literature and by contacting the authors of a similar study conducted in the USA that assessed physicians' awareness about CFS using 9 items. Permission to utilize their research tool was granted through E-mail.

A jury of evaluators comprised four reviewers, including a biostatistician, an internal medicine consultant, and two psychiatrists, and evaluated the construct validity of the study questionnaire using nine criteria created for the evaluation of questionnaires (by Good and Scates [26]). The evaluation criteria covered various aspects of the research tool, including the length, appeal, depth, suggestiveness, ability to elicit responses, potential for embarrassment, credibility, restricted or limited in philosophy, and ability to answer the basic purpose for which the questionnaire was designed. Each criterion received a score on a scale ranging from "excellent" to "poor" (5=excellent, 4=very good, 3=good, 2=fair, and 1=poor). The research tool was assessed for internal consistency (reliability) based on the Cronbach's alpha level.

The independent variables of this study included "having ever diagnosed a case of CFS" and sociodemographic data made up of gender, age, training level, years of practice, years practicing primary health care (PHC), graduation year, country where medical degree was obtained, months spent in training, and latest achieved degree (obtaining a certified family medicine diploma prior to joining the present program).

Data management
The data were analyzed using the Statistical Package for Social Sciences software (SPSS) 23rd version. The Attitude questions were reverse coded, and the data were tested for the normality of the distribution to determine the proper analytic tests. Continuous data were presented as the mean, median, and standard deviation, and categorical data were presented as percentages. Linear regression was used to analyze the relationships between continuous variables, and multiple linear regression was employed to control confounding factors and highlight significant correlations []. Dummy variables were created to accommodate categorical independent variables in the regression models []. Possible confounding variables for which the data were adjusted included gender, years spent in practice and PHC, months spent in training, graduation year, and obtaining a certified family medicine diploma before joining the current training program. The Kruskal-Wallis test was used as an alternative to one-way ANOVA for multilevel categorical independent variables when significant outliers were found. The Mann-Whitney test was employed both to analyze two-level categorical independent variables and after the Kruskal-Wallis test to compare groups. Significance was determined at a P value <0.05 and a confidence level of 95%.

RESULTS
The average score for this research questionnaire based on the evaluation performed by the jury of evaluators to ascertain the construct validity was "excellent". Four questions were removed from the initial 23-item construct to increase the level of internal

consistency as determined by a Cronbach's alpha of 0.61. Seventy trainees completed the 19-item questionnaire for a response rate of 95.89%. Normality was analyzed using the Kolmogorov-Smirnov test. The Perception, Belief, and Attitude dimensions were normally distributed (P value >0.05, Sig. of 0.2 for Perception, 0.058 for Belief, and 0.196 for Attitude). The Knowledge and Total Awareness dimensions were not normally distributed (P value <0.05, Sig. of 0.001 for Knowledge and 0.015 for Total Awareness).

Two groups of "Level 1 Diploma" trainees completed the current study. The "D1 Old Group" was trained for approximately ten months, and the "D1 New Group" was trained for less than two months at the time of the current study (Table 1). Four (5.7%) board trainees had been Family Medicine Diploma certified before joining the Saudi Board of Family Medicine.

Correlations:
Belief Results
Linear regression established that "age" significantly predicted Belief [$F_{(1,68)}$=4.935, p<0.05 (Sig. 0.03)] and accounted for 6.8% of the explained variability in the level of Belief (R^2=0.068). Additionally, "months spent in training" significantly predicted Belief [$F_{(1,68)}$=14.505, p<0.005 (Sig. 0.0003)] and accounted for 17.6% of the explained variability (R^2=0.176). After adjustment for possible confounders, we found that the whole regression model was significant (p=0.007) and that both "age" and "months spent in training" significantly predicted Belief (unstandardized coefficients B=2.278, p=0.045 and unstandardized coefficients B=0.440, p=0.005, respectively).

Knowledge Results:
Linear regression established that "age" significantly predicted the level of Knowledge [$F_{(1,68)}$=4.575, p<0.05, Sig. 0.036, unstandardized coefficient B=0.175)] and accounted for 6.3% of the explained variability in the level of Knowledge (R^2=0.063), whereas "graduation year" had an inverse correlation with Knowledge [$F_{(1,68)}$=5.593, p<0.05 (Sig. 0.021, unstandardized coefficient B=-0.197)] and accounted for 7.6% of the explained variability in the level of Knowledge (R^2=0.076). Additionally, "years spent in practice" significantly predicted the level of Knowledge [$F_{(1,68)}$=5.033, p<0.05 (Sig. 0.028, unstandardized coefficient B=0.186)] and accounted for 6.9% of the explained variability in the level of Knowledge (R^2=0.069). Multiple linear regression analysis was performed to control the effect of all possible confounding variables on Knowledge, but the whole regression model not significant (p=0.311).

Attitude Results:
Linear regression established that "age" significantly predicted Attitude [$F_{(1,68)}$=4.335, p<0.05 (Sig. 0.041)] and accounted for 6% of the explained variability in Attitude (R^2=0.06, unstandardized coefficient B=1.405)). Moreover, "graduation year" significantly predicted Attitude [$F_{(1,68)}$=14.226, p<0.05 (Sig .0.014)] and accounted for 8.6% of the explained variability in the level of Attitude (R^2=0.086, unstandardized coefficient B=-1.731). Additionally, "months spent in training" significantly predicted Attitude [$F_{(1,68)}$=7.297, p<0.05 (Sig. 0.009)] and accounted for 9.7% of the explained variability in Attitude (R^2=0.097, unstandardized coefficient B=0.395). After adjustment for the confounding variables, the whole regression model was not significant (p=0.073).

Perception Results:

Perception significantly differed only between the males and females in an independent T-test that assumed equal variances (Sig. 2-tailed=0.025). The Mann-Whitney test showed a significant difference in the means of Perception among males (mean rank=21.55) and females (mean rank=37.82) (U=439.5, z=2.353, p=0.019). After adjustment for possible confounders, we found that the whole regression was significant (p=0.026) and that only "female gender" significantly predicted Perception (unstandardized coefficients B=5.796, p=0.005).

Total Awareness Results:
Linear regression established that"graduation year", "age" and "months spent in training significantly predicted the Total Awareness level. "Graduation year" significantly predicted the Total Awareness level [$F_{(1,68)}$=9.90, p<0.05 (Sig. 0.002)] and accounted for 12.7% of the explained variability (unstandardized coefficients B=-0.992), whereas "age" was significant [$F_{(1,68)}$=10.69, p<0.05 (Sig. 0.002)] and accounted for 13.6% of the explained variability (unstandardized coefficients B=0.998). Additionally,"months spent in training" significantly predicted the Total Awareness [$F_{(1,68)}$=19.08, p<0.005 (Sig. 0.000044)] and accounted for 21.9% of the explained variability (unstandardized coefficients B=0.280). Pairwise comparisons between groups of trainees performed using the Kruskal-Wallis H test revealed significant differences in the median Total Awareness scores between the"D1 New Group" (70.52) and the "R4 group" (76.84) (adjusted p=0.032) and between the "R1 group" (70.52) and the "R4 group" (76.84) (adjusted p=0.016) but not between the other groups. To identify actual differences, the Mann-Whitney test was conducted between the "D1 New group" and the "R4 group" and showed a significantly higher mean rank for the "R4 group" (mean rank 14.11) than for the "D1 New Group" (mean rank 6.30) (Sig. 0.002). The Mann-Whitney test also showed a higher mean rank for the "R4 Group" (mean rank 16.89) than for the "R1 group" (mean rank 7.77) (Sig. 0.001). After adjustment for possible confounders, the whole regression model was significant (p=0.001), and only "months spent in training" significantly predicted Total Awareness (unstandardized coefficients B=0.231, p=0.024).

Impact of having ever diagnosed CFS on the dependent variables:
We analyzed the impact of having ever diagnosed a case of CFS on the Perception, Attitude and Belief dimensions using an independent samples T-test. The results were significantly different (Sig. 2-tailed of 0.027), with physicians who had diagnosed a case of CFS having a lower mean of Perception (M=66, SD=12.43) than physicians who diagnosed a CFS case (M=79, SD=11.15) with a significant difference in the means (M=13.09, 95% CI) (Pearson correlation coefficient=-0.265). Neither the Attitude nor Belief dimension significantly differed between the groups (Sig. 0.603 and 0.832, respectively). The Mann-Whitney test was used to analyze the impact of having ever diagnosed a case of CFS on the Knowledge and Total awareness dimensions, but the differences were not significant (Sig 0.669 and 0.486, respectively). The mean scores of the tested dimensions were 81% for Knowledge, 78.34% for Perception, 69.77% for Attitude, 77.71% for Belief, and 72.22 for Total Awareness.

DISCUSSION
The mean scores of the tested dimensions (Tables 2 and 3) were all "moderate" with the exception of the Knowledge dimension, which was "high". The lowest score among the tested dimensions was found for the Attitude dimension.

Table 2: Central tendencies of the tested dimensions

Statistics						
		Knowledge Percentage	Percep-tion Percentage	Attitude Percentage	Belief Percentage	Total Aw-areness Percentage
N	Valid	70	70	70	70	70
	Missing	0	0	0	0	0
Mean		81.0476	78.3429	69.7714	77.7143	72.2256
Median		80.0000	80.0000	68.0000	80.0000	71.5789
Mode		73.33	80.00	76.00	70.00a	72.63
Std. Deviation		11.93842	11.54686	14.77382	10.08088	6.96923
[a] Multiple modes exist. The smallest value is shown.						

Table 3: Scores achieved in the study dimensions

Dependent Variable Scores (%)						
	Low		Moderate		High	
	n	N %	n	N %	n	N %
Knowledge	1	1.4%	27	38.6%	42	60.0%
Perception	1	1.4%	33	47.1%	36	51.4%
Attitude[a]	16	22.9%	35	50.0%	19	27.1%
Belief	3	4.3%	31	44.3%	36	51.4%
Total Awareness	2	2.9%	59	84.3%	9	12.9%

[a] Shown as the % of positive attitude (reverse coded).

BELIEF

The current study analyzed Belief based on six questions that assessed agreement that CFS was a distinct disease. Seventeen (24.3%) trainees disagreed that CFS existed (strongly disagree and disagree combined), 23 (32.8%) agreed (strongly agree and agree combined), and 30 (42.9%) were undecided. In comparison, approximately half of the participants of the Thomas et al. (2005) UK study agreed that the condition existed. Thirty-one percent of Australian GPs surveyed by Steven et al. did not believe that CFS was a distinct disease [29, 30]. Moreover, doctors were unlikely to recognize CFS as a distinct disease in Brazil because medical record reviews identified no such cases [31]. Brimmer et al. [32] found that 51 to 72% of physicians agreed on the existence of CFS in the U.S. The majority (58%) of GPs surveyed by Fitzgibbon et al. (1997) in England accepted CFS as a distinct disease [33]. Bowen et al. [34] found that 72% of GPs recognized CFS as a recognizable clinical entity in England, whereas 28% did not.

Knowledge

The current study assessed the Knowledge dimension with three questions that involved the criteria needed to diagnose CFS, whether CFS was diagnosed by exclusion and whether CFS was exacerbated by exertion. Sixty percent of the participants had a high level of knowledge, and 38.6% had a moderate level of knowledge. In contrast, Bowen et al. found that 49% of surveyed GPs correctly identified key clinical features of CFS [34]. The healthcare providers interviewed by Brimmer et al. [32] had a high level of knowledge.

Attitude

The present study assessed physicians' attitudes using five questions, three of which were identical to those employed by Brimmer et al. [32]. A total of 15 (21.4%) trainees agreed that CFS was not as large a problem as the media suggested, compared to 128 (10%) of the comparison study population; additionally, 16 (22.9%) trainees agreed that CFS patients were just depressed in comparison to 147 (12%) in the comparison group, and 8 (11.4%) trainees agreed that "if people with CFS rest they will get better" in comparison to 116 (9%) in the comparison group [32]. Steven et al. [30] found that 21.7% of surveyed Australian GPs believed that CFS was most likely caused by depression. These findings suggest that the misbelief that CFS is caused by depression is prevalent among physicians. Despite being a criterion for the CFS diagnosis, approximately 10% of the compared groups disregarded the hypothesis that the fatigue caused by CFS was never relieved by rest.

A total of 16 (22.9%) participants of the current study had a low positive attitude score, 35 (50%) had a moderate positive attitude score, and 19 (27.1%) had a high positive attitude score. Bowen et al. (2005) concluded that 413 (57%) of the participants in their study had a positive attitude score, 59 (8%) were neutral, and 256 (35%) had a negative attitude score [34].

PERCEPTION

Perception was evaluated in the present study through 5 questions, one of which was "the majority of people with CFS were fully functional and productive before they got sick". Forty-five (64.3%) trainees agreed with that statement, which was closely related to the statement employed in Brimmer et al. [32] (i.e., the majority of people with CFS were competitive, driven to achieve, and compulsive before getting sick), with which 541 (43%) healthcare workers in the comparison group agreed. The present study showed that female

physicians had a higher Perception value for CFS. To illustrate the possible origin of differences in Perception between males and females, we must note that Saudi Arabia is socioculturally unique. Male and female patients in Saudi Arabia are treated in separate clinics, and a female doctor may encounter female patients more frequently than male patients during her career. Those and other factors (e.g., learning style preferences among genders and the higher prevalence of CFS among female patients shown in previous studies) could explain the origin of differences in the Perception dimension among genders.

Total Awareness

The present study shows that longer training durations are associated with higher Total Awareness and Belief scores. Older physicians had higher levels of Total Awareness compared to younger physicians who were also recent graduates. Furthermore, "R4" trainees (who spent at least four years in training) had the highest Total Awareness level.

In the present study, only 4 (5.7%) physicians reported having ever given a diagnosis of CFS, whereas 41% of the sample surveyed by Brimmer et al. [32] had diagnosed CFS. The physicians who diagnosed CFS did not have significantly higher scores on any dimension (Total Awareness, Knowledge, Attitude, Perception and Belief). Because the family physician's level of awareness is expected to be reflected in his/her ability and confidence to diagnose CFS cases, the current study highlights a possible unpreparedness of family physicians to diagnose CFS.

In summary, the present study showed that the age of the participants positively influenced all dependent variables in this study except Perception, which was influenced by only female gender. The positive influence of age could have occurred because the increased age of the participants was mostly associated with increased field experience and hence the possibility of exposure to more fatigued patients in general. One exception to that attribution was those physicians who chose nonclinical pathways before joining the current training program (i.e., academic lecturers). Recent graduates scored lower on the Knowledge, Attitude and Belief dimensions. The duration of training was reflected in the Attitude, Belief and Total Awareness dimensions. Moreover, the training duration does offered the trainees a chance to reshape and improve their awareness in the tested dimensions but did not lead to increased detection of CFS cases.

Adjustment for all possible confounders confirmed that the Perception dimension was related to the female gender and importantly that the Total Awareness and Belief dimensions were correlated to the duration spent in training (Table 4).

Advantages and Limitations of the Study

Advantages

Since neither the prevalence nor the level of awareness has been previously assessed in Saudi Arabia, the present study is expected to assist the development of CFS education strategies. The construct validation and internal consistency measurement (reliability) add an advantage to the current study. Furthermore, the questionnaire was piloted on 32 participants, none of whom were included in the study. Moreover, the high response rate (95.89%) this study achieved strengthened our findings. The present study controlled all possible confounders to ensure the obtainment of a statistically sound result that could be interpreted accurately.

Limitations

The present study had several limitations. The population of the study was limited to one geographical area, although other programs existed, including several other programs in different regions of Saudi Arabia. A larger sample that is inclusive of other areas will be more representative of the actual situation. Additionally, 85.7% of the participating trainees were female; this factor has to be cautiously regarded during the interpretation of the perception scores, which were significantly higher for females. Another limitation is that comparisons with other studies were executed, although possible differences in the rating techniques used could exist.

CONCLUSION

Although the overall awareness score was moderate, an in-depth analysis showed score discrepancies in the investigated dimensions. The lowest score was found in Attitude, which was in the same context as previous studies and was due to the tendency of physicians to conjoin CFS and depression. Moreover, most of the participants were not convinced that CFS was a distinct disease, which in agreement with findings from other countries. The training duration positively impacted the level of Awareness and Belief but was not reflected in the Perception, Knowledge, or Attitude. Generally, family medicine trainees demonstrated unpreparedness to diagnose CFS, and even physicians who had diagnosed CFS did not have a high level of awareness.

Recommendation

Advanced practical educational methods should be implemented early in the training program, especially for shorter training programs.

To emphasize the fact that CFS is diagnosed by exclusion, training programs should expose trainees to a variety of differential diagnoses of chronic fatigue scenarios.

Educational programs should consider Perception differences among males and females, explore that area in future research, and utilize the findings to improve the training program's structure.

Abbreviations

Abbreviation	Explanation
SEID	Systemic Exertion Intolerance Disease
ME	Myalgic Encephalomyelitis
CFIDS	Chronic Fatigue Immune Dysfunction Syndrome
PVFS	Post-Viral Fatigue Syndrome
GCC	Arab Gulf Cooperation Countries (GCC)
CFS	Chronic Fatigue Syndrome
CDC	The Centers for Disease Control and Prevention
GPs	General Practitioners
ANOVA	Analysis of Variance
SPSS	Statistical Package for the Social Sciences
GET	Graded Exercise Therapy
POTS	Postural Orthostatic Tachycardia
O&NS	Oxidative and Nitrosative Stress
CBT	Cognitive Behavioral Therapy
HRV-BF	Heart Rate Variability Biofeedback
PHC	Primary Health Care
SBFM	Saudi Board of Family Medicine
SDFM	Saudi Diploma of Family Medicine
ABFM	Arab Board of Family Medicine
MBBS	Bachelor of Medicine, Bachelor of Surgery
D1 New Group	Level 1 SDFM trainees who were trained for less than 2 months at the time of the study
D1 Old Group	Level 1 SDFM trainees who were trained for 10 months at the time of the study
D2 Group	Level 2 SDFM trainees who were trained for 20 months at the time of the study
R1 Group	Level 1 SBFM trainees who were trained for less than 2 months at the time of the study
R2 Group	Level 2 SBFM trainees who were trained for 12 months at the time of the study
R3 Group	Level 3 SBFM trainees who were trained for 24 months at the time of the study
R4 Group	Level 4 SBFM trainees who were trained for 36 months at the time of the study

Ethics approval and consent to participate

Approval from the Ethical Committee of the Post-graduate Saudi Board Program, Eastern Province, was gained before conducting the study (approval no R.C.109/37). Informed consent was obtained from all participants who agreed to participate in our study.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and analyzed in the current study are available from the corresponding author upon reasonable request.

Competing interests

There are no conflicts of interest

Authors' Contributions

Dawood Adnan Al Nasser is the corresponding author; Elham Ahmad Al Janahi is a co-author, contributed as a supervisor and participated in writing the results and the discussion; and Olfat Saleh Janbi is a co-author and contributed to the discussion.

Table 1: Demographic characteristics of the participants

Characteristics		n	N %	Mean	Median	Mode	Min.	Max.	SD
Gender	MALE	10	14.3%						
	FEMALE	60	85.7%						
Years spent in practice				2	2	1	0	15	3
Years spent in PHC[c]				1	1	0	0	15	2
Year of graduation from medical college				2012	2013	2011	2000	2015	3
Months spent in training				13	12	1	1	36	12
Country where bachelor degree was obtained	SAUDI ARABIA	60	85.7%						
	BAHRAIN	10	14.3%						
Current training program	SDFM	33	47.1%						
	SBFM	37	52.9%						
Latest achieved degree	BACHELOR DEGREE	66	94.3%						
	DIPLOMA CERTIFIED	4	5.7%						
Current level of training	D1 NEW GROUP[d]	10	14.3%						
	D1 OLD GROUP[e]	9	12.9%						
	D2[f]	14	20.0%						
	R1[d]	13	18.6%						
	R2[g]	10	14.3%						
	R3[h]	5	7.1%						

	R4[i]	9	12.9%							
Ever diagnosed CFS case?	NO	66	94.3%							
	YES	4	5.7%							

[a]SBFM=Saudi Board of Family Medicine,[b]SDFM=Saudi Diploma of Family Medicine, [c]PHC= Primary Health Care,
[d]trained for less than 2 months,[e]trained for 10 months, [f]trained for 20 months, [g]trained for 12 months, [h] trained for 24 months, [i]trained for 36 months.

Table 4: Significantly related independent variables to the dependent variables.

Characteristics		P Value (adjusted)[a]				
		Knowledge	Attitude	Belief	Perception	Total Awareness
Age		$0.036^d (>0.05)^c$	$0.041^d (>0.05)^c$	$0.03^d (0.045)^c$		$0.002^d (>0.05)^c$
Gender	MALE					
	FEMALE				$0.019^b (0.005)^c$	
Years spent in practice		$0.028^d (>0.05)^c$				
Year of graduation from medical college		$0.021^d (>0.05)^c$	$0.014^d (>0.05)^c$			$0.002^d (>0.05)^c$
Months spent in training			$0.009^d (>0.05)^c$	$<0.005^d (0.005)^c$		$<0.005^d (0.024)^c$
Current level of training	D1 NEW GROUP					
	D1 OLD GROUP					
	D2					
	R1					
	R2					
	R3					
	R4					$<0.005^e (>0.05)^c$

[a] Adjusted for confounders, significant p-values are highlighted in bold letters, whereas empty cells represent non-significant correlations,[b] Independent sample T-test,[c]Multiple linear regression,[d]Linear regression,[e]Mann-Whitney,

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