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Research article

A suggested scientific research environment measure SREM in medical faculties

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ABSTRACT

Background: Creating a supportive environment for scientific research is vital to improve the quality of research and its impact on development of society. This study outlines the development of a new scale that can measure the scientific research environment of postgraduate medical students. This tool aimed to allow medical institutions to measure their scientific research environment from the researchers' point of view. This may ensure an appropriate scientific research environment for researchers by identifying and overcoming obstacles.

Methods: Based on literature, an initial list with 58 items was formulated. After discussing with postgraduate students and academic staff members from Damascus University and the Syrian Virtual University, A 38-item scale remained from the initial list of 58 items. To test the scale, postgraduate medical students (n = 30) were asked to fill the scale and answer 38 questions-with a 5-point Likert scale-twice in two separate occasions. The Pearson's correlation coefficient was performed to study the internal correlation. The internal consistency test was performed with Cronbach's Alpha, and the Test-Retest Reliability was conducted to study the reliability of the scale. Moreover, factor analysis was used to determine the sampling adequacy.

Results: Thirty postgraduate medical students at Damascus University completed the 38-item scale. Scale scores in the sample displayed good reliability in relation to published results. Findings, showed an internal correlation among its sub-scales. The results showed an acceptable reliability values such as internal consistency ($\alpha = 0.863$) and test–retest reliability (ICC = 0.093). KMO had a value bigger than 0.7 (KMO = 0.849) which indicate sampling adequacy, also, Bartlett's test of the sphericity was (1142.76, Df = 91, *P-value* = 0.000) which prove meaningful of the factor analysis. The results of varimax rotation found that five main factors were retained.

Conclusions: The Scientific Research Environment Measure (SREM), can be suggested as an effective evaluation instrument which can be applied easily to assess the scientific research environment of postgraduate medical students. This would help the decision makers to support teaching, learning, and research environment through implementing new strategies that inspire postgraduate medical students and increase their engagement.

1. Introduction

Medical research is an essential part of healthcare efforts that can play a critical role in clinical practice. The quantity and quality of

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research papers are important indicators of the scientific progress of each country [1]. However, medical researchers are still facing various obstacles during undertaking their scientific research [2]. Several factors play a role in ensuring the quality of medical research. Some of these factors are related to researchers and their research skills, and others are related to educational environment and supervising process [3]. Ensuring an appropriate environment for students while undertaking research is still a source of concern in all universities, as this task faces various challenges, and these challenges may have negative effects on the research process [4].

Educational environment measuring tools continue to be developed to measure the learning conditions to ensure the quality of the educational process. The Dundee Ready Education Environment Measure (DREEM) was developed in 1997 to measure the state of the undergraduate medical school's learning and teaching climate [5]. The Anaesthetic Trainee Theatre Educational Environment Measure (ATEEM) was developed to measure the educational environment for trainee anesthetists in the theatre setting [6]. In 2007, The Postgraduate Hospital Educational Environment Measure (PHEEM) was developed to demonstrate whether trainees are working and learning in a good environment. PHEEM has proved to be a reliable and consistent tool to assess educational climate [7]. Using similar methodology to the existing tools, more instruments were developed to evaluate the educational environments in all medical specialties, and it was applied to various universities, hospitals or institutions concerned with medical education [8,9]. SATORI is a measurement tool that focuses on scientific research environment. It is a 50-statement tool that has been designed to assess the knowledge translation in research institutes their strengths and weaknesses toward identifying solutions for the improving the organization's capacity and infrastructure [10].

In Syria, researchers' efforts continue to develop and design new tools to explore the environment of different Syrian health professionals and investigate areas that require more attention. The Syrian Empathy Scale (SES) was recently developed for assessing

Table 1
The SREM -items grouped by sub-scale.

	Perceptions of research atmosphere
1	The university provides suitable places to work on the completion of scientific research.
2	The university provides the necessary tools, materials, and devices to conduct the research.
3	Financial support for scientific research is insufficient. *
4	The university's libraries contain the references and books necessary for writing the research.
5	The university facilitates access to databases, electronic libraries, and international journal websites.
6	The available period for the completion of scientific research is sufficient.
7	The formal procedures for registering scientific research in the specialized university councils are complex. *
8	The formal procedures for registering scientific research in the specialized university councils are long. *
9	Additional tasks (teaching burden/supervision of undergraduate students) hinder the completion of scientific research *
Perceptions of autonomy	
10	All researcher students are treated equally without discrimination.
11	The scientific research topic is chosen according to the supervisor's decision *
12	There are clear instructions regarding procedures for submitting a complaint in case of a problems occurred between the student and the supervisor.
13	The supervisor's replacement procedures are difficult.*
14	The student personally chooses the appropriate supervisor for scientific research.
Perceptions of the social atmosphere	
15	There is an atmosphere of respect and affection between the supervisor and the student.
16	Work is coordinated with the supervisor to complete scientific research as a team.
17	I feel uncomfortable when interacting with the postgraduate researcher colleagues *.
18	The postgraduate researcher colleagues refuse to help and collaborate with me during the completion of the research. *
Perceptions of supervision	
19	My supervisor has experience in supervising scientific research
20	I feel the supervisor is not enthusiastic to supervise my research *
21	The supervisor is committed to set periodic appointments to discuss with me.
22	The time allocated by the supervisor to follow up my research progress is insufficient.*
23	The supervisor is constantly aware of the development of knowledge related to my scientific research topic.
24	The supervisor is stalling the nomination to defend my scientific research. *
25	The supervisor provides continuous feedback about the research.
26	The student/supervisor ratio is balanced.
27	The teaching load of the supervisor prevents him from supervising my research well.*
28	The supervisor performs his complete role and duties in the completion of scientific research.
29	There are difficulties in communicating with the supervisor. *
30	The supervisor asks me to complete personal tasks related to his/her own job. *
Learning opportunities and academic-self perceptions	
31	Doing the research enhances my critical thinking skills
32	Doing the research hinders my social communication skills *
33	Doing the research improves my self-learning capabilities.
34	Doing the research develop my searching strategies in the educational databases
35	I am doing a traditional and non-original scientific research *
36	Doing the research improves my personality as a scientific researcher
37	I feel unenthusiastic to pursue my research *
38	I wish not to work in the field of scientific research later*

* negative items.

Each positive item is accompanied by a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Each negative item is accompanied by a 5-point Likert scale, ranging from 1 (strongly agree) to 5 (strongly disagree).

the empathy of Syrian health professionals in the field of health care [11].

Several studies in the medical literature show that the postgraduate research activity faces a number of obstacles, and highlights the need for stimulating further research on this critical issue [12,13]. Despite the evidence, there is no current scale for assessing the scientific research environment, which means that solutions will be limited with many gaps in identifying obstacles precisely.

Therefore, this study aimed to develop a new scale that can measure the Scientific Research Environment (SREM) for the first time. In addition, a pilot study was undertaken to test the SREM in Damascus University, Syria.

2. Materials and methods

After obtaining the ethical approval from the ethical committee of the Syrian Virtual University (SVU) (Number: 47810), the first stage was done by designing an initial list with 58 items by the principal researcher (MY) in collaboration with the research supervisor (MD). The preliminary list of items was prepared based on previous related studies after undertaking a comprehensive literature review [10,14].

Effort being made to design items that have been worded simply and unambiguously, not offensive or potentially biased in terms of social identity such as gender, religion, ethnicity, race, economic status, or sexual orientation [14].

Then, at the second stage, postgraduate students in the Program of Medical Education at the SVU were invited to participate in a focus group in order to test the list.

Acknowledging the fact, that content adequacy is vital for making sure that items are measuring what they are presumed to measure [14], content validity was emphasized through asking experts and postgraduate students to judge whether the items are having contents relevance and content representations [14].

Experts who were independent of those who designed the items [14], were invited to participate in a focus group by the principle researcher (MY) directly. They were medical professors at Damascus University who have several research activities and supervise research of postgraduate students. In addition, a total of 20 postgraduate students who accepted to be part in the study, were also involved. Informed consent was obtained from all participants after full explanation about the scale and aim of study. Five professors accepted to take part in the study, to provide opinion about the designed items and to participate in discussion group. Addition, modifications, or deletions were performed in the light of feedback received and the list minimized to 45 items.

To increase the validity and reliability, more revision and modification were undertaken in the third stage, in order to test the clarity and the relevance of statements in the light of the aim of the study [11]. The same participants were re-invited again to use a 5-point Likert scale, ranging from strongly agree' (5) to strongly disagree (1) was used to record responses. The cutting point was determined, as previously described, at 4 out of 5 in which items with a mean score of more than 4 were considered as highly relevant that should be remained in the list [15].

About 38 items remained to form the Scientific Research Environment Measure (SREM).

Table 2
The SREM sub-scales scoring and interpreting the responses.

Perceptions of research atmosphere:
9–18 = The atmosphere is inappropriate for scientific research
19–27 = Needs many improvements
28–36 = The atmosphere has a lot of positives
37–45 = The atmosphere is excellent and suitable for scientific research
Perceptions of autonomy:
5–10 = No students' autonomy at all
11–15 = Lots of work needed to promote students' autonomy
16–20 = Students have good autonomy
21–40 = Students have full autonomy
Perceptions of the social atmosphere:
4–8 = Unpleasant social atmosphere
9–12 = a lot of social discomfort and tension
13–16 = suitable social atmosphere
17–20 = typical social atmosphere
Perceptions of supervision:
12–24 = Bad supervision
25–36 = The supervision needs many improvements
37–48 = Good supervision
49–60 Ideal supervision
Learning opportunities and academic-self perceptions:
8–16 = No educational opportunities or benefits
17–24 = Inconsiderable educational benefits
25–32 = Good learning opportunities and self-development
33–40 = High learning opportunities and self-development
The total score of SREM scale:
38–76 = A poor educational environment, not suitable for scientific research.
77–114 = Lots of negatives that need improvement
115–152 = Good educational environment for scientific research
153–190 = Excellent environment for scientific research

The final instrument produced, the Scientific Research Environment Measure (SREM), with 5 relevant sub-scales. The five relevant sub-scales were as follows: perceptions of research atmosphere (9 items), perceptions of autonomy (5 items), perceptions of the social atmosphere (4 items), perceptions of supervision (12 items), and learning opportunities and academic-self perceptions (8 items). The SREM instrument is outlined in Table 1. The maximum score for each sub-scale: Perceptions of research atmosphere: $9 \times 5 = 45$ max; Perceptions of autonomy: $5 \times 5 = 25$ max; Perceptions of social atmosphere: $4 \times 5 = 20$ max; Perceptions of supervision: $12 \times 5 = 60$ max; and learning opportunities and academic-self perceptions: $8 \times 5 = 40$ max. This is made up of the number of items in the sub-scale times the maximum mark on a Likert scale of 1–5. The possible maximum score of the scale is 190 and the minimum score is 38. Information about managing SREM, scoring and interpreting the postgraduate medical students' responses are given in Table 2. Eighteen of the items were negatively written. Scoring was reversed for negative items in order to obtain the same direction of positive items. At the fourth stage, an invitation letter was sent to postgraduate researchers, who were working in medical colleges. Sixty-eight researchers responded to this invitation. Thirty researchers accepted to participate according to their time and working loads. A sample of 30 post graduate medical students from Damascus University were asked to answer the SREM after providing them with brief instructions and clarification. The informed consent was obtained from all subjects. Demographic characteristics such as age, gender, ethnicity, institution, and discipline, were collected. General information including the level of postgraduate study, duration spent in completing the research, the academic grade of the supervisor, the supervisor' gender, the number of studies previously supervised by the supervisor, and the number of studies currently supervised by the supervisor, were also collected. After a period of two weeks, the same students were asked to complete the scale again for the second time.

Factor analysis was performed with all variables included in the analysis. Bartlett's test of the sphericity and KMO (Kaiser Meyer Olkin) were performed to measure the validity of the factor analysis. The principal component analysis was performed to extract the number of components. Scree plot was used to visualize the results. The retained components were submitted to a varimax rotation with criteria of eigenvalue >1. Factor coefficients greater than 0.4 were used to make the interpretation of suggested components [11]. Factors in the tables were sorted by size.

Data analysis was carried out using the Statistical Package for the Social Sciences (SPSS version 22), and statistical tests were conducted to analyze the distribution of the data. Pearson's correlation coefficient was performed to test the internal correlation among the five sub-scales. The internal consistency test was studied using the Cronbach's Alpha. The Test-Retest Reliability was conducted to study the reliability of the scale. An inter-class correlation test (Test-Retest Reliability) was conducted to study the reliability of the answers in the studied sample. The data were collected for the first time, and then the data were re-collected for the second time to ensure the stability of the answers. Exploratory data analysis was also performed to establish the distribution of all variables. Shapiro-Wilk test was used to study the normal distribution of each sub-scales. The *P value* of less than 0.05 was considered to be significant. The STROBE checklist related to reporting observational studies was utilized in order to provide comprehensive information about the research [16].

3. Results

The final sample size included 5 university professors, 20 students doing master's degree in medical education from different faculties. Table 3 shows the details of the sample included in the development of this scale. This preliminary study was conducted with the participation of thirty postgraduate students (Table 4). All of the total 30 postgraduate medical students of Damascus University ($n = 30$) completed the SREM (response rate 100%) with valid responses for analysis.

The values showed a normal distribution for all of the five sub-scales, where the significance level value was greater than (0.05). Findings are presented in Table 5. Pearson's correlation coefficient showed the existence of several essential values, where, which indicates a fundamental correlation between a number of sub-scales (Table 6).

An internal consistency test was performed with alpha-correlation coefficient (Cronbach's Alpha) to study the strength and reliability of the scale. The test result showed that the 38 items of the scale were of excellent strength, as the test result was (0.863).

The test was repeated when each item of the scale was deleted. Table 7 shows the value of the alpha correlation coefficient when removing each item of the scale, as its value increased slightly when item No. 35 was deleted, and the value of the correlation coefficient became (0.875). The test results showed a high value of reliability between the two stages, as the value of the test was (0.093).

Table 8 represents the results of factor analysis which included all the research variable, KMO was 0.849, which is higher than 0.7 and represents good sampling adequacy, also, the results of Bartlett's test of the sphericity was (1142.76, df = 91, *P value* < 0.001) which means that factor analysis results are acceptable.

Table 3
Sample included in the development of the scale.

Type		Male	Female	Total
Professor	**dentistry**	2	1	3
	Pharmacy	1	0	1
	Medicine	1	0	1
	Total	4	1	5
Master degree student (medical education)	**dentistry**	4	5	9
	Pharmacy	1	4	6
	Medicine	2	4	5
	Total	7	13	20

Table 4
Sample included in the research.

Type		Male	Female	Total
Master degree student	**dentistry**	10	6	16
	Pharmacy	1	5	6
	Medicine	5	3	7
	total	16	14	30

Table 5
Tests of normality.

	Shapiro-Wilk		
	Statistic	Df	Sig.
The total score of the scale	.911	10	.285
Perceptions of research atmosphere	.914	10	.306
Perceptions of autonomy	.912	10	.292
Perceptions of social atmosphere	.930	10	.446
Perceptions of supervision	.843	10	.058
Learning opportunities and academic-self perceptions	.968	10	.874

Table 6
Internal correlations.

		The total score of the scale	Perceptions of research atmosphere	Perceptions of autonomy	Perceptions of social atmosphere	Perceptions of supervision	Learning opportunities and academic-self perceptions
The total score of the scale	Sig. (2-tailed)						
Perceptions of research atmosphere	Sig. (2-tailed)	.156					
Perceptions of autonomy	Sig. (2-tailed)	.063	.792				
Perceptions of social atmosphere	Sig. (2-tailed)	.000*	.242	.033*			
Perceptions of supervision	Sig. (2-tailed)	.000*	.356	.044*	.000*		
Learning opportunities and academic-self perceptions	Sig. (2-tailed)	.045*	.761	.846	.210	.096	

* an internal connection between the two sub-scales.
**Correlation is significant at the 0.01 level (2-tailed).

Moreover, the results of the factor analysis extracted 5 components, and the results of initial Eigenvalues, percentages of variance, and cumulative percentages are represented in Table 9. Factor 1 had the highest percentage of variance (40.19%), factor 2 (14.71%), factor 3 (13.58%) of the variance, factor 4 (11.01), and finally factor 5 (6.5%).

The results of varimax rotation are presented in Table 10 five main factors were retained (eigenvalue >1). Fig. 1 presents the eigenvalues scree plot of each of the factors, 5 factors had eigenvalues over 1.

Factor 1 was labeled **Perceptions of research atmosphere** and was based on 9 components, factor 2 was labeled as **Perceptions of autonomy** and was based on 5 components, factor 3 was labeled as **Perceptions of social atmosphere** and was based on 4 components, factor 4 was labeled as **Perceptions of supervision** and was based on 12 components, and finally factor 5 was labeled as **Learning opportunities and academic-self-perception** and was based on 8 variables.

4. Discussion

This study aimed to design the first scale that depends on researchers' point of view in evaluating the scientific research environment. Through thirty-eight items, the researchers was able to answer the question "Is the scientific research environment suitable for researchers?" This relates to several areas that the institutions and research supervisors must provide support and guidance to researchers in order to be able to complete the research. This tool could be described as a researcher-reported outcome measure, as it enable researchers to reflect on their current reality, thus giving the research institutions the opportunity to explore challenges and obstacles that face researchers so they can take action to remove them. This should be resulted in increased number of research activities and publications that consequently improve the ranking and reputation of the faculty.

Several studies focused on increasing the research activities and number of publications, without taking initiatives to investigate

Table 7
Studying the value of the alpha correlation coefficient when omitting each of the items in the scale.

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach' Alpha if item deleted		Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach' Alpha if item deleted
q1	114.4000	223.600	.291	.862	q20	113.4000	224.044	.454	.858
q2	115.1000	228.322	.270	.861	q21	115.0000	212.444	.667	.852
q3	115.8000	233.067	.231	.862	q22	114.3000	200.011	.853	.844
q4	114.7000	212.233	.615	.853	q23	113.9000	223.211	.324	.861
q5	115.2000	227.067	.707	.858	q24	114.4000	223.378	.297	.861
q6	112.8000	243.289	−.551	.869	q25	114.6000	198.267	.892	.843
q7	112.4000	244.044	−.501	.870	q26	114.2000	215.067	.597	.854
q8	112.6000	253.378	−.588	.878	q27	113.8000	216.400	.617	.854
q9	114.4000	221.600	.346	.860	q28	114.2000	211.067	.803	.849
q10	114.7000	217.567	.634	.854	q29	113.4000	222.267	.527	.856
q11	114.0000	256.000	−.619	.881	q30	113.7000	214.456	.398	.860
q12	115.4000	232.267	.234	.862	q31	113.4000	216.933	.518	.855
q13	115.2000	223.956	.627	.856	q32	113.5000	214.278	.657	.852
q14	114.9000	225.656	.452	.858	q33	112.7000	238.233	−.151	.866
q15	113.2000	226.844	.471	.859	q34	112.8000	233.733	.179	.863
q16	114.3000	196.678	.944	.841	q35	113.0000	250.000	−.559	.875
q17	112.8000	235.511	.041	.864	q36	113.0000	232.222	.134	.864
q18	112.8000	237.956	−.147	.865	q37	113.8000	223.067	.392	.859
q19	113.6000	213.600	.569	.854	q38	113.6000	220.044	.388	.859

Table 8
KMO and Bartlett's test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.849
Bartlett's Test of Sphericity	Approx. Chi-Square	1142.761
	df	91
	Sig.	.000

Table 9
Total variance explained.

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	6.431	40.194	40.194
2	2.354	14.712	54.906
3	2.174	13.587	68.493
4	1.763	11.017	79.510
5	1.043	6.519	86.028

the research environment and explore factors that negatively affect research activities and productivity of researchers. The systematic review undertaken by Wood and co-workers (2018) indicated that culture of research is the most important factor that can improve research activities. The review has addressed the importance of enabling leaders to design cost-effective interventions that can increase resident scholarly activities such as local, regional, national presentations and peer-reviewed publications [17]. About 90% of the global burden of diseases occurs in developing countries, and it should be noted that most of these diseases are preventable infectious diseases [18]. Despite this, developing countries still suffer from a lack of scientific research activities to solve problems related to disease outbreaks. The reasons for the lack of scientific research are due to the lack of research capabilities and commercial viability [19]. The actual reality of scientific research environment in Syria still faces several obstacles. In 2011, a report demonstrated that between 1980 and 2011, only 593 papers in the medical literature were published from Syrian medical institutions [20]. An observational survey that gathered self-reported data indicated to the presence of many barriers that prevent the medical students' participation in scientific research. However, this observational survey showed that Syrians already managed to partially tackle some of the obstacles imposed by the poor research environment [21].

The study was undertaken to test the newly designed scale that measure the scientific research environment of postgraduate medical students. The scale has been developed with content formulated by different stakeholder groups including medical students, medical education master's students, and medical education teaching staff. The findings showed the SREM has been a practical, simple and quick tool that can be used for assessing the scientific research environment in medical schools.

Scientific Research Environment Measure (SREM) consists of 38 items (20 positive statements and 18 negative statements). Each item is accompanied by a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The SREM scale is easy to manage. It has proper internal consistency and construct validity. The SREM scale also showed good test-retest stability. This is the first

Table 10
Rotated component matrix.[a].

Q	Component					Q	Component				
	1	2	3	4	5		1	2	3	4	5
q38					.786	**q22**				.553	
q37					.705	**q16**			.336		
q36					.608	**q14**		.650			
q29				.598		**q17**			.256		
q27				.480		**q35**					.762
q20				.506		**q18**			.384		
q23				.452		**q10**		.227			
q19				.348		**q26**				.119	
q13		.679				**q8**	.480				
q15			.551			**q28**				.350	
q1	.896					**q3**	.533				
q2	.869					**q9**	.508				
q5	.788					**q4**	.546				
q32					.151	**q34**					.856
q24				.375		**q7**	.255				
q30				.941		**q11**		.217			
q25				.662		**q31**					.526
q21				.615		**q12**		.311			
q6	.749					**q33**					.465

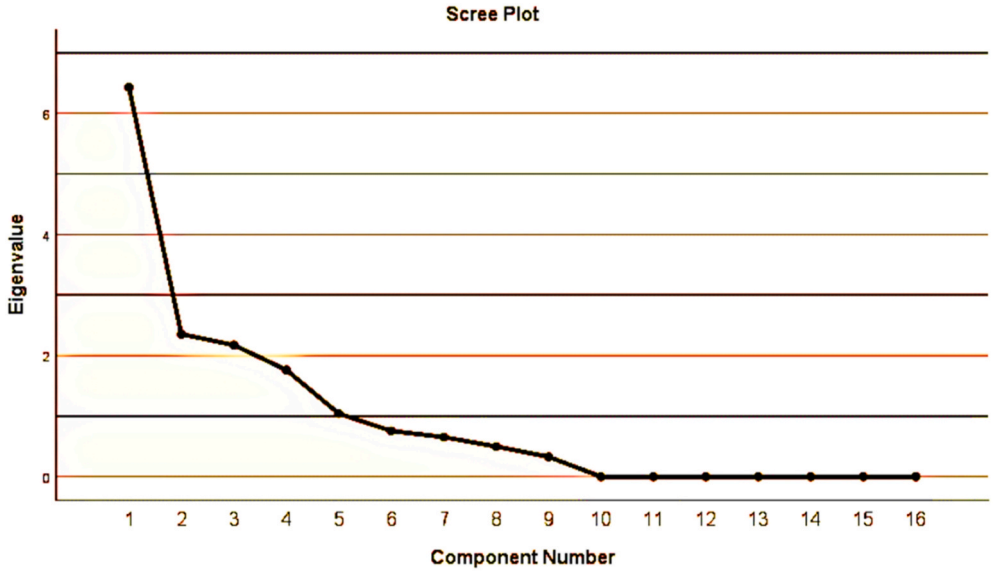

Fig. 1. Presents the eigenvalues scree plot of each of the factors, 5 factors had eigenvalues over 1.

attempt to develop a tool that measures the postgraduate medical research environment, which may help to accurately identify the obstacles in each medical school and later measure the differences existed.

The findings of this study indicated that the appropriate atmosphere is an essential factor for scientific research. The elements of this scale indicate the students' need for an infrastructure equipped to conduct scientific research at the university, in addition to the university's ability to provide financial support to researchers and facilitate their access to databases. The given period to complete the research must be available without wasting it with complex or long formal procedures or other tasks within the university not related to scientific research. Some educational and official factors are perceived to be obstacles that negatively affect the completion of postgraduate medical scientific research. In the lack of stimulating educational environment, some students consider the achievement of the research as a difficult task that becomes more difficult due to the large additional workload. On the other hand, the good infrastructure and the available financial support are factors that motivate the postgraduate medical students [1]. Each academic institution should contain libraries, halls, and well-equipped laboratories to complete the stages of the scientific research [3]. Therefore, nine statements of the 38-item scale asked the students about the research atmosphere.

Autonomy of the researcher is the first step in creating the scientific personality of this researcher [22]. The scale included 5 statements that measure the autonomy of the postgraduate medical students. Findings indicated that students did not have always the

opportunity to choose the supervisor, which can consequently affect their satisfaction and negatively affect their attitude towards their research. Previous work indicated that the students should have the opportunity to choose the appropriate supervisor [23]. This scale demonstrates postgraduate students' need not only for the choosing of the supervisor, but even the procedures for replacing the supervisor and submitting complaints in the case of any problem should be more clear.

Furthermore, the student should also select the topic of the research because this will increase the motivation and enthusiasm to complete the research in the best possible way. Likewise, discrimination on religious, cultural, or ethnic basis shouldn't be existing [24]. However, when tensions arise the student must be fully aware of the procedures to submit a complaint to the directors of postgraduate studies. The students should also know that the change of a supervisor could be requested in some exceptional circumstances [22].

Four statements asked the students about the social atmosphere. Through these statements, students expressed the need for an appropriate social atmosphere at the university while conducting the research. In their opinion, this means that all supervisors and colleagues should work together as a team within an atmosphere of affection and respect. Researchers encountered several problems during the research period, including miserable working conditions, loss of motivation, depression, and loneliness [24]. Students must act professionally with each other to maintain mutual relations among the researchers, the colleagues, and also the supervisors [2]. Maintaining good communication is the key for success of research mission [25].

Supervision was the most controversial point within this scale. The postgraduate students' perceptions of supervision were measured in this scale through 12 different statements. This essential focus on supervision can be explained by the fact that the supervisor is the researcher's partner in completing or even not completing the research. Supervising requires that the supervisor possess many skills that scientific experience alone is not sufficient. Through this scale, students ask that the supervisors have enough time to complete the supervision tasks without the presence of other burdens and tasks. Supervisors must be passionate about scientific research, committed to their duties, and cooperate with the students to complete the scientific research without having other goals that they might use their position to impose on the students. The literature indicates that roles, responsibilities, and expectations must be clarified from the beginning. Students and supervisors must work together in an atmosphere of respect, commitment, and collegiality [22]. Role ambiguity can lead to unprofessional behaviors [2]. Poor research supervision through limited feedback may contribute to the research. Besides, the lack of support may delay the completion of the research [26]. The less active and enthusiastic the supervisor is, the less likely the student will learn, so the effectiveness of the supervisor is an important way to help the students to learn [24]. Several supervisors consider the task of supervision to be a challenge for them due to the lack of time and the excessive workload. Excessive numbers of postgraduate students will cause a problem when the ratio is not balanced between the number of researcher students and the number of supervisors [2].

Undoubtedly, the main purpose of the scientific research is not just to complete it to obtain a certain certificate, but the real goal is to make scientific researchers capable of adding more to medical science through their researches. The (SREM) scale includes 8 statements for evaluating learning opportunities and academic-self perceptions. The postgraduate students expressed their hope for scientific research to develop their abilities in communication, scientific thinking, self-learning and scientific research strategies. These are things that develop their personalities as researchers and make them feel motivated to continue their work in scientific research in the future. The literature demonstrated that postgraduate medical students should not think that their duty is just to complete the research, but rather to possess scientific research competencies. A student who wants to become a scientific researcher should not be ill-communicating or misses necessary skills to accomplish research tasks [2]. Researchers should strive to achieve several points, the most prominent of which are building self-confidence and readiness to show higher levels of thinking [27]. Studies show that early participation in scientific research assignments enhances the tendencies of graduate students in medical colleges to complete work in the field of scientific research later in their medical careers [28].

Previous systematic review demonstrated multiple barriers to resident scholarly activity productivity encountered by residents like motivation, navigating institutional review boards, time to complete projects, support for study design and analysis [29]. This study documented the costs of the interventions, and considered it very important for programs without being able to determine the best intervention [29]. Previous tool (SATORI) attempted to clarify the institutes' weaknesses and strengths in the field of scientific research [10]. They also classified the scale into main domains, namely: 'priority setting', 'promoting and evaluating the use of knowledge', 'researchers' knowledge translation capacities', 'processes and regulations supporting knowledge translation', 'facilities and pre-requisites of knowledge translation', 'interaction with research users', and 'research quality and timeliness'. These domains are consistent with our current tool, and this similarity confirms that the areas that define the appropriate scientific research environment domains are mostly what was mentioned in our study, but this tool remained measuring from the point of view of the institution rather than the researchers. That may not coincide with the researchers' point of view, and consequently, the obstacles may not be identified precisely and comprehensively [10].

SRME is a necessity because obstacles still arise and hinder the completion of scientific research, as the number of publications is still low in some developing countries as a result of the lack of completion of these researches. Furthermore, researchers should be familiar with the characteristics of the ideal environment that should be created for scientific research productivity. Similarly, supervisors of research and all academic members in institution should be aware of the ideal environment that they should establish, in order to enhance scientific research.

In sum, The SREM was found to be a practical tool for assessing the environment for scientific research in Syria. It can also be utilized in other countries to measure the environment of their research institutions. This tool covers the most important requirements, resources, and facilitating strategies for scientific research at the post graduate level. The tool could be easily used by research authorities of any research institute to identify barriers facing scientific research environment and to suggest appropriate solutions. The comparison of the scientific research environment strengths and weaknesses, based on the scores gained through this scale can help the

medical institutes define intervention priorities. Failure to implement this scale will prevent researchers from expressing their opinion towards scientific research environment and this would negatively affect their scholarly productivity.

Our review has several limitations, the items were developed based on the opinions of a group of researchers, experts and graduate students in a university research institution in Syria, which may shed light on problems related to this region only, and may overlook problems that exist in other countries and research institutions. Therefore, further studies with a larger sample size and in different universities are still essential to ascertain our findings and confirm the validity and reliability of this measure in assessing the scientific research environment. In addition, more research should be undertaken to evaluate the scientific research environment for post-graduate students in other faculties of health professions in many universities and countries. This will inevitably reflect positively on the level of scientific research and researchers' competencies. From our point of view, this measurement should be a turning point in the scientific research environment in institutions that seriously aspire to identify the pros and cons. Institutions that adopt such tools can adjust their policies based on what the data shows, and this will allow them to quickly adapt to any obstacles that may arise and impede the of scientific research productivity.

However, it seems that the research environment is somewhat similar in research organizations located in many developing countries. As a result, the standardized-version of the tool can be used in other research organizations. Our point of view, this measurement may become a turning point in the scientific research environment in institutions that seriously aspire to identify the pros and cons. Institutions that adopt such tools can adjust their policies based on what the data shows, and this will allow them to quickly adapt to any obstacles that may arise and impede the of scientific research productivity.

5. Conclusions

The SREM is an effective evaluation instrument with five relevant sub-scales: perceptions of research atmosphere, perceptions of autonomy, perceptions of the social atmosphere, perceptions of supervision, learning opportunities and academic-self perceptions. The measure with its 5-point Likert points is simple to understand and easy to complete, resulting in scores that can be calculated without taking longtime. The measure produces reliable data and valid inferences about the environment of scientific research. However, future investigations are still required to confirm the findings.

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