



**PUBMED- INDEXED ARAB PUBLICATION ON SLEEP DISORDERS DURING THE  
LAST FIFTEEN YEARS**

\*Mustafa Afifi, *MBChB, MMed, Dr. PH, MHPE*

Associate Professor Public Health, Department of Health Sciences, Jumeira University Dubai, UAE.

\*Corresponding Author: Mustafa Afifi

Associate Professor Public Health, Department of Health Sciences, Jumeira University Dubai, UAE.

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**ABSTRACT**

Sleep medicine has evolved into an established specialty. This study aims to analyze fifteen years (2004-2018) of sleep research biomedical publications produced in Arab countries in PubMed. A search of the MEDLINE database was performed on 10<sup>th</sup> August 2018 through PubMed, to identify all publications with the word “sleep” appearing in the title, where the first author was affiliated to an Arab institution. The search results were saved as MEDLINE text files, which were converted into Excel file and then captured as a new database query via SPSS software including 353 records of SPSS data file format. The GCC countries published more than half of the total publication. The sleep publications were published in 189 different journals. However, twelve of them topped the list and covered 32% of these publications. Around 45% of the first authors are affiliated to Internal Medicine departments (including cardiology and chest diseases), basic medical sciences or sleep centers. Faculties, other than the faculty of medicine, that contributed less substantially to sleep publications included Engineering, Pharmacy, or Nursing. We aggregated the topics published by basic medical sciences, medicine departments, and sleep centers and the gaps in sleep research or the new trends were then discussed.

**KEYWORDS:** Arab countries sleep disorders, PubMed.

**INTRODUCTION**

Sleep disorders are prevalent and constitute risk factors for cardiovascular disease, metabolic disorders, cognitive impairment, accidents and poor quality of life. Despite its public health importance, studies in developing countries are scarce and sleep awareness is limited.<sup>[1]</sup> Sleep disorders also show co-morbidity with many somatic diseases such as renal failure, diabetes, and dementia, and/or mental disorders including affective disorders, schizophrenia, and drug abuse.<sup>[2,3;4;5;6;7]</sup> Sleep disorders are known to affect all age groups. Almost half of all children experience a sleep problem, where early diagnosis is important to prevent many other problems such as poor academic achievements and road traffic accidents.<sup>[8]</sup> Among seniors, sleep is a real challenge as it can become difficult to sleep for 8 hours in a single block. However, evidence has shown the positive impact that good and healthy sleep has on elderly mental health, including a reduction of suicide rates.<sup>[9,10]</sup> It is also advisable to know the difference between the age related sleep problems and the real sleep disorders which should be properly diagnosed.<sup>[11]</sup>

Motivated by the aforementioned magnitude of sleep problems and disorders, I examined the number and percentage of PubMed publications during the last 30 years ("1988/01/01"[Date - Publication]: "2017/12/31"[Date - Publication]) with the word sleep in

the title (Sleep [ti]). The retrieved articles accounted for 3.2% of total publications. This ratio was then re-examined considering only those publications from Arab countries (with the first or the corresponding author affiliated to any of the 22 Arab countries specified in the methods section). Approximately 2.2% of the PubMed indexed Arab publications had “sleep” in the title. Comparing the two figures (3.2% vs. 2.2%), it is evident that sleep studies are less in Arab countries albeit its public health magnitude. However, counting publications with the word “sleep” in its title is still a gross Bilbometric method. The results could be relevant to research productivity or could need further checking or to be interpreted with care.<sup>[12]</sup>

Therefore, we aimed in the current study to perform a quantitative and qualitative analysis on the Arab publications with the word “sleep” in its title, during a 15 year period from 2004 to 2018. We will examine its trend, compare between the Arab countries, and investigate the collages or faculties’ departments to which the research is affiliated. Finally, we will identify the gaps in sleep research and suggest recommendations to address them.

**METHODS**

The geographical distribution of biomedical publications in general and mental health research specifically, as an

indicator of the research productivity of individual countries has recently become a field of interest.<sup>[13]</sup> A sensitive PubMed search strategy was undertaken by including the names of the 22 Arab countries, as well as their variants in French language within a single hour limit (August 10<sup>th</sup>, 2018). A more detailed methodology can be found in previously published articles.<sup>[13]</sup> The number of PubMed indexed biomedical publications with the first and/or the corresponding author affiliated to any Arab-country based institution, published between 1<sup>st</sup> January 2004 and 10<sup>th</sup> August 2018 totaled 124,959 publications.

The second stage was to search within the same period of time, in the title heading (ti) database of the MEDLINE, for articles where the title included the word "sleep". This encompassed sleep problems, disorders and even publications concerning normal sleep. The search returned 48,217 publications. The two search strategies were then combined using the Boolean operator "AND" to get the "sleep" publications for each of the 22 Arab countries over the last 15 years, totaling 386. The abstracts of the search were then thoroughly read to exclude the following records: irrelevant publications to sleep problems and/ or disorders, AND those with the first author affiliated to a department in any of the NON-Arab countries due to leaving the job or changing affiliation. The total search decreased from 386 to a final of 353. It was noticed that publications of 2018 were NOT completed in August and therefore the 2017 publications almost doubled it. However, they were retained for analysis, acknowledging such limitation. This file was saved in a MEDLINE format of a text file. The text file was converted, using a locally designed visual basic program, into a Microsoft Excel file which included all those fields present in the MEDLINE format text file. Then the Excel file was captured as a new database query via SPSS software ending by the same number of records of SPSS data file format with the same fields of the Medline format of these publications. The SPSS data file was then conventionally subjected to data management, applying a methodology used in previously published articles. This methodology was previously used in published articles with a different research focus, and years of and different years of publications.<sup>[14-16]</sup>

The final variables included for statistical analysis were: PMID, year of publication, authors' number (single or many authors), the journal type (paper or online), the journal name (abbreviated name), country of publications, department that conducted the study, and study title. After the management phase, analysis of the data was done using SPSS version 22.0. Data are presented as counts, means, and percentages.

## RESULTS

**Table 1** displays the total number of sleep related publications indexed in PubMed of the Arab countries. The GCC countries published more than half of the total

publication. Figure 1 distributed the publications across the years for the three groups of countries: 1- Arab countries excluding Egypt and GCC, 2- Egypt and 3- GCC countries. From the graph, it is apparent that the trend in sleep publications over years has the same pattern for all the three groups of countries. Figure 2 displays the departments where the first author was affiliated. Around 45% of the first authors are affiliated to Internal Medicine departments (including cardiology and chest diseases), basic medical sciences or sleep centers. In addition to the faculty of medicine, other faculties that constituted a smaller proportion of sleep publications including Engineering, Pharmacy, or Nursing. Public Health department and ENT department shared by 5% and 6% of the total publications respectively. Pediatric research on sleep constituted 16% of the total publication where Pediatric Department released 44% of them and the rest by other disciplines. Approximately 16% of the total publications were authored by a single author. It is evident that the GCC countries have a significantly higher percentage of single author publications compared with Egypt and other Arab countries (Table 2). The sleep publications examined were published in 189 different journals. However, sorting the journals discerningly by their number of publications, the top 12 of them (Table 3) covered 32% of these publications. The following paragraphs are the aggregation of topics published based on the department of the first author for the top three departments namely; basic medical sciences, medicine departments, and sleep centers.

### Basic Medical Sciences Departments

Six papers dealt with therapeutics that prevent memory impairment induced by Chronic Sleep deprivation such as L cartinie, Melatonin, Vitamin C, Tempol, Vitamin E and Pentoxifylline. Other papers were investigating the association or the link between Vitamin D, insulin resistance, obesity, Type 2 Diabetes, depression, anemia, high altitude, fasting in Ramadan and/or mobile phone ration and sleep disorders. About 18 percent of publications from basic health sciences department were lab experiments on rats.

### Internal Medicine Departments (including cardiology, rheumatology and chest diseases)

The majority of the publications focused on obstructive sleep apnea, diagnostic challenges, and its predictors. Some of these studies are on its relation to serum brain neuropeptide levels or EEG changes. Other studies are on its association with obesity, smoking habits, or gender differences. Few authors investigated using Body Media's Sense Wear armband for its estimation or mandibular advancement devices for management. The relationship of sleep disorders and deprivation among elderly, obese patients, hemodialysis patients, those with ankylosing spondylitis, and the immunological consequences were also investigated. A single study was a cost-effective study on continuous positive airway pressure. As in the aforementioned part of basic medical

sciences, some of the research are on co-morbidity of sleep disorders with metabolic syndrome, diabetes, arrhythmia, renal failure patients on dialysis, obesity, depression, and rheumatoid disorders. Few studies investigated the association of sleep disorders with academic performance and quality of life.

**Sleep Centers** studied the management (diagnosis and/or treatment) of sleep disorders where some research investigated in cohort studies the long-term compliance with continuous positive airway pressure in patients with obstructive sleep apnea. Those who refused the continuous positive airway pressure, their acceptance to C- FLEX therapy were studied. Other studies compared the nasal prong pressure and thermistor measurements for detecting respiratory events during sleep or the spirometer and flow volume curve in patients with obstructive sleep apnea. Another distinguishing type of study related to sleep centers was specific to the Arabic

and Moslem culture. Many research were investigating the intermittent night sleep and/or the day time sleepiness during Ramadan fasting. Also, some studies investigated the split sleep of dawn Moslem prayers and its impact on daytime sleepiness. Another type of studies in sleep centers are near to health system research where these studies cared about investigating the sleep medicine services in their countries or sleep medicine education among medical students.

With regards to the link between occupational health and sleep medicine, only five studies were related specifically to occupational sleep research. Three of them focused on health care professionals and sleep problems experienced due to their night shifts.

Only two health system research on auditing or evaluating health services provided for sleep disorders in the KSA and Oman.

**Table 1: Country distribution of sleep research in Arab world.**

			Countries categories			Total
			1.00	2.00	3.00	
Country	Algeria	Count	2	0	0	2
		% within Country	100.0%	0.0%	0.0%	100.0%
	Bahrain	Count	0	0	5	5
		% within Country	0.0%	0.0%	100.0%	100.0%
	Egypt	Count	0	75	0	75
		% within Country	0.0%	100.0%	0.0%	100.0%
	Iraq	Count	2	0	0	2
		% within Country	100.0%	0.0%	0.0%	100.0%
	Jordan	Count	23	0	0	23
		% within Country	100.0%	0.0%	0.0%	100.0%
	KSA	Count	0	0	125	125
		% within Country	0.0%	0.0%	100.0%	100.0%
	Kuwait	Count	0	0	7	7
		% within Country	0.0%	0.0%	100.0%	100.0%
	Lebanon	Count	11	0	0	11
		% within Country	100.0%	0.0%	0.0%	100.0%
	Libya	Count	1	0	0	1
		% within Country	100.0%	0.0%	0.0%	100.0%
	Maroc	Count	12	0	0	12
		% within Country	100.0%	0.0%	0.0%	100.0%
	Oman	Count	0	0	17	17
		% within Country	0.0%	0.0%	100.0%	100.0%
	Palestine	Count	3	0	0	3
		% within Country	100.0%	0.0%	0.0%	100.0%
Qatar	Count	0	0	17	17	
	% within Country	0.0%	0.0%	100.0%	100.0%	
Tunis	Count	37	0	0	37	
	% within Country	100.0%	0.0%	0.0%	100.0%	
UAE	Count	0	0	16	16	
	% within Country	0.0%	0.0%	100.0%	100.0%	
Total	Count	91	75	187	353	
	% within Country	25.8%	21.2%	53.0%	100.0%	

1. Arab countries rather than Egypt and GCC countries
2. Egypt
3. GCC countries

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	706.000 <sup>a</sup>	28	.000
Likelihood Ratio	716.692	28	.000
N of Valid Cases	353		

a. 29 cells (64.4%) have expected count less than 5. The minimum expected count is .21.

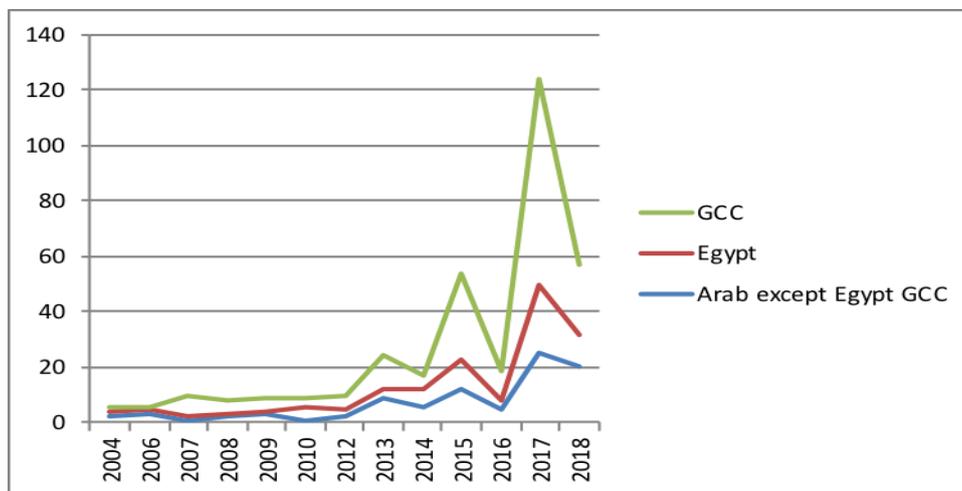


Figure 1: Temporal trend of sleep research within the Arab world during the last 15 years.

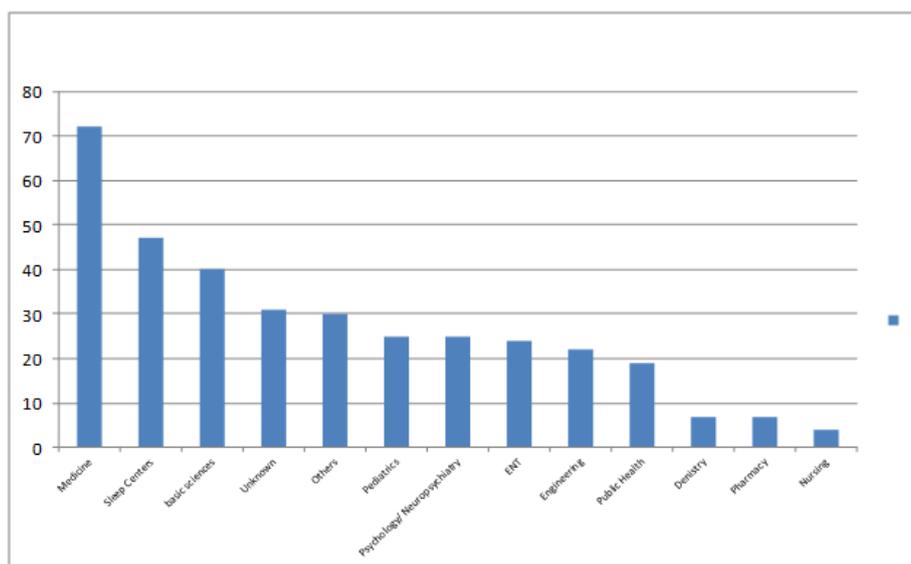


Figure 2: Top departments publishing sleep research in the Arab world.

Table 2: Percentage of papers with single authorship by countries of origin.

Countries * SingleAU Crosstabulation					
			Single author		Total
			1	2	
Countries categories	1.00	Count	4	87	91
		% within countrybin	4.4%	95.6%	100.0%
	2.00	Count	12	63	75
		% within countrybin	16.0%	84.0%	100.0%
	3.00	Count	42	145	187
		% within countrybin	22.5%	77.5%	100.0%
Total		Count	58	295	353
		% within countrybin	16.4%	83.6%	100.0%

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.560 <sup>a</sup>	2	.001
Likelihood Ratio	17.413	2	.000
Linear-by-Linear Association	14.243	1	.000
N of Valid Cases	353		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.32.

**Table 3: Top Journals publishing sleep research in the Arab world.**

	Journal name	Number	%
1	Saudi Med J	23	6.5
2	Sleep Breath	22	6.2
3	Ann Thorac Med	17	4.8
4	Ann Saudi Med	10	2.8
5	Conf Proc IEEE Eng Med Biol Soc	6	1.7
6	J Clin Sleep Med	5	1.4
7	Libyan J Med	5	1.4
8	Neurosciences (Riyadh)	5	1.4
9	Oman Med J	5	1.4
10	Rev Mal Respir	5	1.4
11	Sleep	5	1.4
12	Sultan Qaboos Univ Med J	5	1.4
13	Other Journals	240	68
	Total	353	100

## DISCUSSION

PubMed publications' analysis in a country or a region helps policy makers to link science to health and societal goals. It also helps focus academic research to cover the untapped topics.<sup>[17-21]</sup> The current study shows the geographical distribution of sleep disorder publications among Arab countries and its linear trend of increase during the last 15 years.

Given the relatively short history of sleep medicine research, some countries such as the KSA show prolific production of sleep related studies. However, one of the limitations of this study was ignoring normalization of the publications by different indicators such as Gross Domestic Product and population size. Countries leading in the publication of certain topics could lose their rank after normalizing them to population size.<sup>[14-15]</sup> Added to the aforementioned limitation, Arab studies are usually published in their local, or non-PubMed, indexed journals and there is no database for grey publications.<sup>[16]</sup> However, and to the best of our knowledge, the current study is the first to quantitatively and qualitatively analyze studies with the word "sleep" in its title for the Arab countries.

Looking at the aforementioned aggregated topics studied and published based on the department of the first author in the results, it was clear that some important or priority research areas have not been covered. To improve sleep medicine research in the Arab world, the gap in priority areas for sleep research should be addressed. The 2011 National Institutes of Health (NIH) Sleep Disorders Research Plan and the 2014 Sleep Research Society and

the American Academy of Sleep Medicine Joint Strategic plan identified the following priority areas for research:<sup>[22]</sup>

1. Understanding of age- and sex-related differences in circadian biology.
2. Investigating the genetic factors increasing the risk of sleep disorders.
3. Identification of basic mechanisms for circadian diseases.
4. Developing tools to improve diagnosis and treatment of sleep disorders.
5. Investigating the health and societal effect of sleep deficiency
6. Establishing research networks supporting the goals of the NSDRP.

Sleep research performed by pediatric departments in medical schools or nursing schools constituted only 7% and 2% of the total publications in this study. However, some research focused on school students were affiliated with other medical departments. Nurses can play a pivotal role in addressing the problem of sleep disorders among school age children. Around 27% of school age children receive inadequate sleep and 29% of them have difficulty awakening in the morning. Therefore, school nurses with access to this data could help advance sleep research for this target group.<sup>[23]</sup> School nurses could also monitor the actigraphs worn by children, especially those with attention-deficit hyperactivity disorder, autism spectrum disorder, or mild intellectual disability.<sup>[24]</sup>

Besides the already known approaches to evaluate sleep in children including actigraphy, polysomnography,

electroencephalography and questionnaires and diaries, there are some new approaches available.<sup>[25]</sup> Mouthon and Huber reviewed these methods in their published paper, and stated that high-density electroencephalography, simultaneous electroencephalography–functional magnetic resonance imaging and nonpharmacological methods aiming for a modulation of sleep are only used for research but might become valuable methods for clinical application in the future.<sup>[25]</sup>

There is a need to extend our research on sleep medicine to workers in different occupational groups. Our study showed that the Arab researchers focused primarily on health professional sleep problems over other occupations. A more diverse data set could promote occupational health policy in the Middle East. Yuriko reviewed 24 Japanese studies; 13 on non-shift workers and 11 on shift workers. His results showed that insomnia prevalence varied among different occupations and could be even higher among non-shift workers than shift workers. He also found that factors other than shift working are associated with poor sleep quality such as general health conditions, occupational activities, personal relations, job stress, job dissatisfaction, workload, life style behavior, and existing psychopathology as depressed mood.<sup>[26]</sup>

Only two studies in our research belong to auditing of sleep medicine services. The ratio of health system research to the overall research in the Arab countries is relatively low in the current study as in other previous studies.<sup>[16]</sup> Given that 13% of the Arab studies came from sleep centers and sleep medicine evolved nowadays to a full grown specialty, there is a need to publish guidelines for the certifications of Arab health care professionals working in sleep medicine. Peverangie *et al* introduced the qualification for professionals practicing sleep medicine in European sleep medicine centers.<sup>[27]</sup>

None of the research in the current study is related to genetic research such as gene mutations involved with circadian clock, or the sleep deprivation effects on brain gene expression.<sup>[28]</sup> Precision medicine aims to analyze diversity in individual genetic information, lifestyle and the environment a person is exposed to, and provide medical practitioners with the ability to anticipate the most effective prevention and management approaches for a certain disease occurring in different patients.<sup>[29]</sup> Although the GCC countries publishing more than half of the sleep publications are high income countries and the KSA had Sleep Medicine Centers, there is very limited research investigating the opportunities for precision public health and precision medicine approaches in these countries.<sup>[30]</sup> The global efforts to explain sleep functions have not yet revealed a complete understanding of sleep. Sleep duration is variable according to biological demands of the human beings.<sup>[28]</sup> Therefore we especially in Arab countries need precision medicine approach to sleep disorders. Moreover, in

recent years, sleep research has left the sleep labs and gone “Wild” to study the interaction between ecology and sleep behavior and neurotransmitters.<sup>[31]</sup>

### Conclusion and recommendations

There is a need to establish sleep medicine centers in all Arab countries because only KSA has them.

More attention should be given to pediatric sleep disorders and to the methods or approaches that diagnose and/or treat them.

There is a massive need to have guidelines for training and certification of health professionals working in the field of sleep medicine.

Precision medicine and public health- a new disciple in medicine- shall be adopted in sleep medicine.

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