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RESEARCH ARTICLE

Evaluation of the Role of Twitter in Increasing the Awareness and Knowledge about Diabetes Among Citizens of Saudi Arabia

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Abstract:

Purpose:

The objective of this research was to evaluate the role of Twitter in increasing the awareness and knowledge of diabetes among citizens of Saudi Arabia.

Methods:

In this research we used a purposive sampling method and carried out a quantitative experimental study design. The participants were adults Twitter users from Saudi Arabia that had relative diabetic patients. The sample size was 200 participants, which were divided into an intervention and a control group. Each group consisted of 100 participants. The intervention group was recruited through Twitter, and the control group was recruited through WhatsApp. Data were analyzed and interpreted using statistical techniques, such as paired t-test, the simple t-test and the ANOVA.

Results:

The mean diabetes knowledge test (DKT) score of the intervention group was Mean=13.57, SD= 3.46. After the intervention process, the mean (M) increased to 17.06 and the standard deviation (SD) decreased to 2.35. According to these outcomes, the paired t-test showed that the use of Twitter had an influence on increasing diabetes awareness. Instead, for the control group, the mean (M) was 13.68, and the standard deviation (SD) was 3.72 at the baseline. During the study process, the mean (M) of the control group increased to 14 and the standard deviation (SD) augmented to 3.59. Then, according to the paired t-test, we concluded that in the control group, there was no effect on the participants' knowledge.

Conclusion:

The results suggested that Twitter had a positive impact on increasing awareness and diabetes knowledge among adult Twitter users in Saudi Arabia.

Keywords: Twitter, SANAD, Awareness, Knowledge, WhatsApp, Diabetes.

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1. INTRODUCTION

Diabetes mellitus is one of the most common chronic diseases worldwide and there are two types of diabetes: type 1 and type 2 [1, 2]. Type 1 diabetes mellitus, also known as insulin dependent diabetes is caused by the failure of the pancreas to produce insulin, which is an important hormone that helps the glucose get into the cells [1]. This type of diabetes develops commonly in children and affects only 5% of diabetic patients. Similarly, type 2 diabetes mellitus, which is also known as non-insulin dependent diabetes, is the most common type that affects around 95% of diabetic patients [2]. It occurs either when the pancreas is not able to produce enough insulin or when the body's cell resists the insulin.

In relation with this disease, approximately 463 million adults (20-79 years) in the world had diabetes in the year 2019 [3]. Among 195 countries in the world, Saudi Arabia ranked number 13 in the prevalence of diabetes worldwide in 2019 [4]. Also, 15.80% of the population of Saudi Arabia (20-79 years) had type 1 or type 2 diabetes in 2019 [4].

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On the other hand, over these years, there was a remarkable growth in the social media networking all over the world. The statistics showed that the total number of smartphone users worldwide was 3.2 billions in 2019 [5]. In particular, it was identified that Saudi Arabia had 20 million smartphone users in 2019 [6]. In addition, social media applications also have become an important medium for exchanging healthcare information. In this sense, several studies have shown the effectiveness of social media in managing health conditions [7 - 11]. Specifically, Twitter has been considered as one of the most popular mobile application used worldwide. It is an online application where users can either read only or post messages called "tweets". With more than 152 million users as of January 2020, the 5 top leading countries of Twitter users (in millions of people) were the United States (59.35), Japan (45.75), the United Kingdom (16.7), Saudi Arabia and Brazil [12, 13].

According to several studies, social networking has great effects on the acquisition of healthcare awareness and medical knowledge about specific diseases [7 - 11, 14 - 18]. For example, a web-based survey carried out between February and March 2015 showed that social media was an important source for seeking medical information and indicated that Twitter had a significant role in increasing medical knowledge [7]. Also, that study showed that there was a persistent need to get evidence-based health information from social media sources. Another study in 2012 indicated that 83% of the participants used some kind of social media to get medical information [8]. Additionally, 56% of them wanted to communicate with their healthcare providers via social media for answering their questions, setting an appointment, reporting test results, and providing health information needed. Moreover, a previous study in 2011 indicated that one third of the participating physicians received friend requests from the patients and their families [9]. One more study in 2011about healthcare consumers showed that 37% of the United State (US) patients searched for their attending physician ratings, which indicated the benefit of social networks to provide health knowledge [10] Further, as it was concluded in a "social media and clinical care" study in 2013, social media had affected healthcare especially in the field of clinical care [11]. Also, Twitter was used for breast cancer awareness in 2013 [14]. That study showed a high breast cancer awareness tweeting interaction in October (breast cancer awareness month). During that month, 1,351,823 tweets were transmitted by 797,827 different users [14]. Likewise, a Twitter account was used for teaching radiology courses [15]. The study suggested that the use of Twitter contributed to enhance education in this field [15]. Another research pointed out that Twitter was a potential data source for cardiovascular disease information [16].

In relation to diabetes mellitus, social media has an incredible role in controlling the growth of this disease. It stimulates the learning process of people who have diabetes mellitus, by encouraging them to ask questions, share experience, and adopt new habits with other people in similar situation. A study conducted in 2015 showed that the Facebook and Skype tools have improved the control of glucose level among patients with type1 diabetes mellitus [17]. The study was carried out with two groups of people: the control group (29 patients) was treated using the standard medical protocol with regular visits at the clinic. While the second group (intervention group) integrated by 27 patients was treated with an insulin pump. The intervention was given via Facebook (chats) and Skype (Video calls). They concluded that social media had a great role in raising knowledge and spreading awareness about diabetes mellitus [17]. Moreover, a meta-analysis study presented the effectiveness of mobile technologies in managing diabetes mellitus. The results revealed that these technologies have improved glycated hemoglobin level for type 2 diabetes [18]. In another research, people with diabetes used Facebook for sharing their clinical information to help each other, receive emotional support, and request guidance [19].

Twitter in specific has been one of the effective social media tools for information dissemination, awareness and knowledge creation among the public. Due to its effective reachability and point-to-point information sharing by linking the relevant users, it can be an effective tool for disseminating information specific to a cause. Unlike other social media tools, twitter can be useful in sending short and relevant information relating to different aspects, which can save readers time in accessing information and also attract their attention. Furthermore, twitter was identified to be effective in creating awareness in various industries. For instance, twitter was used in creating awareness construction safety knowledge in different countries [20]. Furthermore, twitter was also found to be effective in promoting the dialogues among physicians for various activities such as sharing scientific information, crowdsourcing new ideas, conducting discussing and challenging emerging research [21]. Similarly, twitter was also found to be effective in creating awareness among the public in relation to various chronic conditions such as cancer, visual impairment, *etc* [14, 22, 23]. Twitter can also promote information exchange between diverse groups, effectively engaging different people in information exchange and awareness creation. For example, a study on the information exchanges on twitter related to diabetes [24] revealed that a tendency for homophily in which communication among users of differing status and expertise levels is unlikely to exist. Thus, twitter may be effective for promoting information exchange between diverse groups. Moreover, twitter is being used by local health departments in the US for disseminating diabetes information among the local communities, reflecting the potential use of twitter in creating health awareness [25].

Even though there are many studies that measure the role of social media to increase health-related knowledge and information, there was no study in Saudi Arabia that examined the role of Twitter in raising awareness about diabetes. Therefore, the objective of this research was to evaluate the role of Twitter in increasing the awareness and knowledge of diabetes among citizens of Saudi Arabia.

2. METHODS

In this research we used a purposive sampling method and carried out a quantitative experimental study design. The variables analyzed in this study were continuous and categorical. The dependent variable (continuous) was the level of diabetes knowledge, while the independent variables (categorical) were the age, gender, and educational level.

Table 1. Diabetes Knowledge Test (DKT).

	QUESTIONS	No	Yes	Don´t Know
1	Eating too much sugar and other sweet foods is a cause of diabetes.			
2	The usual cause of diabetes is a lack of effective insulin in the body.			
3	Diabetes is caused by failure of the kidneys to keep sugar out of the urine			
4	Kidneys produce insulin.			
5	In untreated diabetes, the amount of sugar in the blood usually increases			
6	If I am diabetic, my children have a higher chance of being diabetic			
7	Diabetes can be cured			
8	A fasting blood sugar level of 210 is too high			
9	The best way to check my diabetes is by testing my urine			
10	Regular exercise will increase the need for insulin or other diabetic medication			
11	There are two main types of diabetes: Type 1 (insulin dependent) and Type 2 (noninsulin dependent).			
12	An insulin reaction is caused by too much food			
13	Medication is more important than diet and exercise to control my diabetes			
14	Diabetes often causes poor circulation.			
15	Cuts and abrasions on diabetes heal more slowly.			
16	Diabetics should take extra care when cutting their toenails.			
17	A person with diabetes should cleanse a cut with iodine and alcohol			
18	The way I prepare my food is as important as the foods I eat			
19	Diabetes can damage my kidneys.			
20	Diabetes can cause loss of feeling in my hands, fingers and feet.			
21	Shaking and sweating are signs of high blood sugar.			
22	Frequent urination and thirst are signs of low blood sugar.			
23	Tight elastic hose or socks are not bad for diabetics			
24	A diabetic diet consists mostly of special foods			

2.1. Study Settings and Participants

The participants were adults Twitter users from Saudi Arabia who had relative diabetic patients. The sample size was 200 participants, who were divided into an intervention and a control group. Each group consisted of 100 participants. The intervention group was recruited through Twitter and they were encouraged to follow the educational Twitter account @sanad_saudi. The control group was recruited through WhatsApp. The members in the control group were recruited by authors by sending the requests for participation, mentioning the condition that they must not be following @sanad_saudi on twitter. Based on the interests or responses received through WhatsApp providing consent of participation, the authors selected the 100 participants who were adults based on the first come first serve basis to avoid any bias. Furthermore, an online survey was distributed among the intervention participants through Twitter direct messages. On the contrary, the survey among the participants of the control group was disseminated through WhatsApp application messages. The participants who completed the study were 70 in the intervention group and 82 in the control group. The informed consent was obtained from all of participants and the ethical approval was obtained from the Imam Abdulrahman Bin Faisal University.

2.2. Inclusion and Exclusion Criteria

The participants included in the control and intervention group of this study were Saudi adult twitter users who have relative diabetic patients. In addition, the intervention group should follow the Twitter educational account: @sanad_saudi. The control group did not follow this account. Other people who were no Saudi adult twitter users were excluded.

2.3. Data Collection

This research was aimed to measure health awareness using the Diabetes Knowledge Test (DKT) presented in Table **1** [26]. As shown in Table **1**, the DKT is a 24-item test developed by Starr County, Texas. In this test, the responses of the participants could be either yes, no, or I don't know. They would get one point if their answer is correct, otherwise, they would not get any point. The DKT was collected twice for the control and intervention groups, at the baseline (beginning) and after one month of the educational program given to the intervention group. The DKT and the educational program were designed online to facilitate their distribution *via* Twitter.

It is pertinent to indicate that the educational program was given to the intervention group for one month using Twitter communications. The program included tweets such as messages, images, statistics, and videos about diabetes information. Additionally, we specified a day, each week, for conducting an interview via tweeter with diabetes and endocrine specialist physicians. Also, the tweeter hashtag called #sanad was activated to interact with the followers and answer their questions. The educational program contained diabetic-related information designed based on the DKT. This information was approved by diabetes and endocrine physicians. The educational program was divided into four sections: definition and types of diabetes, diagnostic tests,

symptoms and precautions, and complications. The period of each section was one week, respectively. At the end of the educational program, the level of diabetes knowledge was measured again. Then, the initial and final scores were compared. The data were recorded in a Microsoft Office Excel sheet to facilitate exporting it to the Statistical Package for the Social Science (SPSS). Ethical approval for the data collection was taken from the Research committee at Imam Abdulrahman Bin Faisal University, Saudi Arabia.

2.4. Statistical Analysis

In this research, we proposed two hypotheses: the null and the alternative hypotheses. The proposed null hypotheses were "Twitter has no effect on diabetes knowledge among Saudi twitter users", while, the alternative hypotheses were "Twitter has an effect on diabetes knowledge among Saudi twitter users".

The paired t-test, the simple t-test and the ANOVA test were used as statistical tests via the Statistical Package for the Social Science (SPSS) version 21. Using this package, we estimated for the data the standard deviation (SD), the mean (M), the mean difference (MD), the standard deviation of the mean difference (SDMD), the standard error of the mean (SEM), the skewness (SK) and the kurtosis (KU) of the data, the 99.5% confidence interval (CI), the t-test values, and the probability values (p-values). The probability (p) for statistical significance was determined as $p < 0.05$. The data was organized in an Excel sheet, and exported to SPSS. The age and sex variable were transformed into codes to facilitate the analysis.

3. RESULTS

The demographic characteristics of the control and intervention participants are represented in Table **2**. Regarding the control group, out of 82 participants, 42.7% were between 20 and 29 years old. Moreover, 65.9% of the participants were female. Also, most of them (62.2%) were academic. In contrast, in the intervention group, out of 70 participants, 88.6% of them were between 20 and 29 years old. Furthermore, 84.3% of the participants were female, and the majority of the respondents (81.4%) were academic.

Table **3** shows the statistical information of the DKT scores of the control and intervention groups before and after the intervention process. At the baseline, this table indicates that the mean (M) for the intervention group was 13.57, and the standard deviation (SD) was 3.46. After the intervention process, the mean (M) increased to 17.06 and the standard deviation (SD) decreased to 2.35. Instead, for the control group, the mean (M) was 13.68, and the standard deviation (SD) was 3.72. During the study process, the mean (M) of the control group increased to 14 and the standard deviation (SD) augmented to 3.59. In addition, this table depicts the mean difference (MD), the standard deviation of the mean difference (SDMD), the standard error of the mean (SEM), the skewness (SK) and the kurtosis (KU) of the data, the 99.5% confidence interval (CI), the t-test values and the probability values (p-values).

Likewise, Table **4** exhibits the comparison of the mean differences and p-values of the age, gender and educational level of the control and intervention groups, using the ANOVA and the independent t-test.

Table 2. Demographic data of the participants (n=152).

Variable	Category	Control Group (n=82)	Intervention Group (n=70)
	20-29	35 (42.7%)	62 (88.6%)
Age range	30-39	21 (25.6%)	7 (10%)
	40-49	20 (24.4%)	1 (1.4%)
	50-59	6 (7.3%)	0 (0%)
Gender	Male	28 (34.1%)	11 (15.7%)
	Female	54 (65.9%)	59 (84.3%)
	Under high school	1 (1.2%)	0 (0%)
Education	High school	25 (30.5%)	12 (17.1%)
	Academic	51 (62.2%)	57 (81.4%)
	Postgraduate	5 (6.1%)	1 (1.4%)

Table 3. Comparison of the application of the paired t-test in control and intervention group.

Group	Outcome Measure	M	SD	MD	SDMD	SEM	SK	KU	95.5% CI	t-value	p-value
Intervention group	Knowledge before	13.57	3.46	3.49	2.25	0.27	0.10	008	(-4.02, -2.94)	-12.95	0.000
	Knowledge after	17.06	2.35			0.16	0.16	-0.14			
Control Group	Knowledge before	13.68	3.72	0.32	1.91	0.21	-0.27	-0.50	(-0.73,0.10)	-1.49	0.138
	Knowledge after	14	3.59				-0.13	-0.62			

Table 4. Influence of age, gender and educational level on increasing knowledge about diabetes.

Group	Factor	Category	SD	MD	Test	Statistic	p-value
Intervention group	Age	20-29 30-39 40-49	2.18 2.34 -	3.58 2.14 7.00	One-way ANOVA	f=2.64	0.079
	Gender	Male Female	2.24 2.23	4.36 3.32	Independent sample t-test	t=1.42	0.160
	Education	High school Academic postgraduate	2.65 2.12 -	2.83 3.68	One-way ANOVA	f=1.98	0.146
Control group	Age	20-29 30-39 40-49 50-59	1.46 2.30 2.23 1.89	0.43 0.29 -0.05 1.00	One-way ANOVA	f=0.53	0.663
	Gender	Male Female	2.44 1.59	0.54 0.20	Independent sample t-test	t=0.74	0.461
	Education	Under high school High school Academic Postgraduate	- 2.59 1.54 1.51	1.00 0.53 -0.40	One-way ANOVA	f=0.70	0.552

4. DISCUSSION

The findings of this study showed that the use of Twitter (SANAD account) had a positive impact on increasing diabetes knowledge among Saudi Twitter users. This proposition was obtained by testing the null and the alternative hypothesis of this research. In this sense, the null hypothesis specified in this study was that the means of the DKT scores before and after the intervention process were the same. In contrast, the alternative hypothesis stated that the means of the DKT scores obtained before and after the intervention practice were not equal.

The results of the paired t-test shown in Table **3** indicated that during the intervention process, the mean of the DKT scores increased to 3.49 in the intervention group, and 0.32 in the control group.

According to this table, the paired t-test showed that in the intervention group there was a statistically significant difference in means of the DKT scores before and after implementing the educational program (p-value < 0.05). Therefore, we can reject the null hypothesis and conclude that the change was due to the educational program which had an effect on participant's knowledge ($t= -12.95$, p-value < 0.05). In other words, the use of Twitter had an influence on increasing diabetes awareness and diabetes knowledge among the participants. In addition, the skewness and kurtosis indicated a normal distribution of data because their values were located between +2 and -2.

In contrast, for the control group, the results presented in Table **3** suggested that, according to the paired t-test, there was no statistically significant difference in means of the DKT scores before and after the process (p-value > 0.05). Therefore, we cannot reject the null hypothesis and concluded that in the control group there was no effect on increasing awareness and knowledge about diabetes among the participants. The observed little difference in DKT scores means was due to chance.

This result is consistent with a similar previous study which stated that breast cancer awareness was increased due to the promotion of health-related knowledge using social media tools such as Facebook [27]. Another research showed that the use of Facebook and Skype had improved the control of glucose level among patients with type1 diabetes mellitus [17]. The intervention carried out in the mentioned study decreased the glucose level from 7.8 ± 1.9 to 6.4 ± 1.6. Also, comparable to our results, several preceding studies showed that the use of Twitter can improve learning abilities and knowledge of participants in several educational settings [15, 28 - 32]. Another additional study suggested the potential impact of social media in enhancing diabetes management, care and outcomes [33].

On the other hand, the results shown in Table **4** related to the application of the independent sample t-test and one-way ANOVA revealed that other factors such as age (p-value =0.07), gender (p-value =0.16), and educational level (p-value=0.14) had no statistically significant influence in increasing diabetes knowledge. This demonstrated the high effectiveness and impact of Twitter (SANAD account) in increasing the awareness and diabetes knowledge of the participants, whereas the other factors (age, gender and educational level) had no effect on it.

The main limitations of this research were the sample size, and the fact that a necessary rewarding mechanism was used to encourage the participant to refill the questionnaire. These limitations were due to the lack of time. In future studies, we will try to avoid these limitations that threat the internal and external validity of this study.

CONCLUSION

The results of this research suggested that social media can contribute to the acquisition of knowledge and the creation of awareness about the treatment of chronic illnesses, such as diabetes and other diseases. In particular, Twitter (SANAD account) had a positive impact on increasing awareness and diabetes knowledge among Saudi adult twitter users. This is an excellent way to use social media tools to promote health

awareness, increase health knowledge, and monitor the health status of human beings.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The ethical approval was obtained from the Imam Abdulrahman Bin Faisal University.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of the article are available in this article.

STANDARDS OF REPORTING

STROBE guidelines were followed.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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