
RETHINKING THE USE OF ARCHITECTURAL HERITAGE ELEMENTS AS A TOOL TO AVOID THE HEALTH RISK OF VITAMIN D DEFICIENCY: AN EXPERIENCE FROM MADINAH, SAUDI ARABIA

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ABSTRAK

Penelitian ini bertujuan untuk menilai kesadaran, pengetahuan, dan sikap masyarakat terhadap vitamin D dan paparan sinar matahari di Madinah, serta mengevaluasi kepuasan masyarakat terhadap berbagai teknik yang digunakan untuk mempertahankan pencahayaan alami di rumah mereka. Penelitian cross-sectional ini dilakukan dengan menggunakan survei online. Analisis data dilakukan menggunakan perangkat lunak SPSS. Sebanyak 925 partisipan berpartisipasi dalam penelitian ini. Mayoritas partisipan berusia 30-49 tahun (55%), berkebangsaan Saudi (69,2%), pemilik rumah (53%), dan tinggal di properti apartemen (54,8%). Sebanyak 92% percaya bahwa vitamin D penting untuk kesehatan, dan 55,6% melaporkan bahwa sumber vitamin D adalah matahari. Sayangnya, hanya 17,2% dan 10,2% yang mengetahui waktu terbaik untuk paparan sinar matahari serta durasi paparan sinar matahari yang tepat untuk mendapatkan vitamin D yang cukup. Sebanyak 73,6% mengalami gejala kekurangan vitamin D. Cuaca panas (59,3%), pakaian konservatif wanita Saudi (26%), serta peningkatan urbanisasi dan gaya hidup dalam ruangan (10,3%) menjadi hambatan utama untuk paparan sinar matahari di Madinah. Sebanyak 75,4% puas dengan tingkat pencahayaan alami yang diberikan oleh Rowshan. Namun, karena biaya yang tinggi dan kesulitan dalam pembersihan, sebagian besar masyarakat enggan menggunakan Rowshan. Penelitian ini menemukan pengetahuan yang tidak memadai dan praktik yang buruk terkait vitamin D dan paparan sinar matahari.

KATA KUNCI: Rowshan, Madinah, Saudi, vitamin D, pencahayaan alami

This research aims to assess the public's awareness, knowledge and attitude toward vitamin D and sun exposure in Madinah, as well as to evaluate people's satisfaction with the different techniques used to maintain daylight at their homes. A cross-sectional study utilizing an online survey was conducted. Data analysis was performed using SPSS software. A total of 925 participants took part in this study. The majority of participants were 30-49 years old (55%), Saudis (69.2%), house owners (53%), and living in flat property (54.8%). 92% believed that vitamin D is important for health and 55.6% reported that vitamin D source was the sun. Unfortunately, 17.2% and 10.2% recognized the best time of sun exposure and the appropriate duration of sun exposure for adequate vitamin D, respectively. 73.6% suffered from the symptoms of vitamin D deficiency. Hot weather (59.3%), conservative dressing of Saudi women (26%) and increased urbanization and increased indoor lifestyle (10.3%) were key barriers to sunlight exposure in Madinah. 75.4% satisfied with the level of daylight provided by Rowshan. However, due to its high cost and difficulty to clean, most of the people reluctance to use Rowshan. This study found inadequate knowledge, and poor practice about vitamin D and sun exposure.

KEYWORDS: Rowshan, Madinah, Saudi, vitamin D, daylight

INTRODUCTION

Saudi Arabia is located in a clear-sky region in the so-called sun belt, which has led it to become one of the largest solar energy producers. Sunlight maintains life and provides energy and light. Sunlight also has positive physical and psychological effects on human being. Research shows that exposure to sunlight increases the brain's release of a hormone called

serotonin (Randy, 2013). Releasing of this hormone in the body helps to make one feel relaxed, happy, and confident. Without enough sunlight exposure, a person's serotonin levels can dip low. Low levels of serotonin are associated with a higher risk of seasonal affective disorder (SAD) which is a form of depression that is triggered by changing seasons (Trisha, 2016). Sunlight also provides one of the most crucial vitamins we require: vitamin D which has several important

functions. Perhaps the most vital are regulating the absorption of calcium and phosphorus and facilitating normal immune system function. Getting a sufficient amount of vitamin D is important for normal growth and development of bones and teeth, as well as improved resistance against certain diseases (Holick, 2006, Bouillon, 2001, DeLuca, 2006). Vitamin D is unusual among vitamins. All other vitamins can only be obtained from diet, but vitamin D can also be made in the body. Synthesis by the body is dependent on a step requiring sunlight, specifically ultraviolet blue (UVB) light reaching the skin. Without exposure to sunlight, little vitamin D will be made by the body. Sunlight increases the synthesis of pre-vitamin D and is considered the main source of circulating vitamin D levels in humans (Holick, 2006). However, vitamin D is also derived from diet and supplements, although the contribution of diet on the circulating vitamin D level is small (Buttriss, 2015).

Although Saudi Arabia is known to be one of the sunniest countries in the world and exposure to sunlight might be assumed to be sufficient to maintain adequate vitamin D status. However, vitamin D deficiency has been well documented in Saudi Arabia. Several studies have showed that vitamin D deficiency is increasing dramatically among Saudi population (Mansour, 2012, Alsuwaida, 2013, Naeem, 2011, Tuffaha, 2013). A recent national survey showed that almost 40% and 60% of males and females in Saudi Arabia respectively had vitamin D deficiency (Alsuwaida, 2013). This unexpected situation may be attributed to religious, social and cultural factors as the conservative dress of Saudi women, especially those who wear dark-colored clothes (abaya), with a headscarf (hijab) and face veil (niqab), blocks exposure to sunlight. In addition, the reduction in outdoor leisure time that has accompanied urbanization in Saudi Arabia and the rise in office-based work has led to an increased lack of sunlight exposure (Mishal, 2001). Low levels of knowledge about dietary sources of vitamin D as well as vitamin D dietary supplements also contributed to the higher prevalence of vitamin D deficiency among Saudi population (Aljefree, 2017). The present study focused on the city of Madinah. Vitamin D deficiency is very prevailing in Madinah. According to Nagib's study, 90% of females living in Madinah had severe vitamin D deficiency (Nagib, 2012). Similarly, another study conducted by a group of female medical students from Taibah University in Madinah showed that vitamin D deficiency was detected in 99% of the female medical students participated in their study (unpublished data) (Alharbi, 2017).

In traditional buildings of Madinah, three main functions were taken into consideration when designing window screens: ensure the lighting of the room without the glare effect; ensure ventilation of

the room through humidity and impurities filtering system and allow people, especially women, who are in the room, to have a look on road without sacrificing privacy (Batterjee, 2017, Alitany, 2014). In Islamic society, women's activities revolve around the house and private life of the family. It is inside their homes where they can take their hijab off and move freely to perform their routine daily tasks. Therefore, the only places where they could absorb the sunlight is inside their homes. Thus, there is a pressing need for architects and building designers to design appropriate homes that tackle the vitamin D deficiency problem.

It was hypothesized that understanding of awareness, knowledge and attitudes of the public toward vitamin D could guide interventions aimed at achieving adequate vitamin D status among the population. An extensive search in the literature reveals that few studies were conducted in Madinah area of Saudi Arabia to assess the public's knowledge and awareness about vitamin D and its deficiency so far. However, these studies focused on female participants only. Additionally, their sample sizes were too small. On the contrary, this study performed on the largest sample size in Madinah up-to-date and included both male and female participants, in order to assess their awareness, knowledge and attitudes toward vitamin D and sun exposure. The study also aimed to evaluate people's satisfaction with the different techniques used to maintain daylight at homes as well as to assess the importance of Rowshan device (a lattice screen enclosure generally built as a wooden window frame, which screened the window space completely) (Figure 1) as a solution to the vitamin D deficiency problem, currently prevalent in Madinah.



Figure 1. Rowshan of traditional buildings in Madinah

METHODOLOGY

A cross-sectional study using developed questionnaire was carried out at Madinah, Saudi Arabia between 15/8/2022-10/11/2022. An online Survey tool (Google Forms) was used to administer the questionnaire among people who lives in Madinah, Saudi Arabia and aged 18 years and above. An invitation message was

sent along with a link to the survey, via emails or WhatsApp application, to family members, friends and community to participate in this study. The survey questionnaire is divided into two sections; the first section included questions related to the public's knowledge and concerns toward vitamin D related issues, such as vitamin D sources and their attitudes toward sun exposure and the social and cultural factors that might potentially contributed to vitamin D deficiency in Madinah. The second section included questions to evaluate the participants' satisfaction with the level of daylight achieved at their homes, as well as to probe the extent of people acceptance of different approaches used to achieve daylight in their homes and their preferences regarding these approaches.

The survey questionnaire used a five-point Likert scale (very satisfied – very dissatisfied or very important - not important); this was done to obtain reliable responses. However, other closed questions allowed for multiple answers were also included. An Arabic translation of the survey questions was made available in addition to the English questions to ensure a better understanding of the questions asked. Data analysis was performed using Statistical Package for the Social Sciences (SPSS) version 26 software (SPSS Inc., Chicago, IL, SA). Descriptive statistics include percentages, and frequency distribution was applied.

RESULTS

A total of 925 participants took part in this survey questionnaire. Of them, 598 (64.6%) were males and 327 (35.4%) were females. The majority of study participants were 30-49 years old (55%), Saudis (69.2%), had university degree (50.8%), house owners (53%), living in flat property (54.8%) and had a monthly income of up to SAR 10,000 (62.9%). The general socio demographic characteristics of study participants are shown in Table 1.

Table 1. The general socio demographic characteristics of the study participants

Variables	Frequency (n)	Percentage (%)
Gender		
Male	598	64.6%
Female	327	35.4%
Nationality		
Saudi	640	69.2%
Non-Saudi	285	30.8%
Age groups		
18-29	204	22.1%
30-39	269	29.1%
40-49	240	25.9%
50-59	111	12%
≥60	101	10.9%
Educational level		
Undergraduate	470	50.8%

Postgraduate	368	39.8%
Interested in heritage House ownership	87	9.4%
Owner	491	53%
Tenant	434	47%
Property type		
Flat	507	54.8%
Villa	418	45.2%
Monthly income		
SAR		
<5000	294	31.8%
5000-10,000	287	31.1%
10,000-20,000	248	26.8%
>20,000	96	10.3%

Participants' knowledge about vitamin D sources and symptoms of its deficiency

Although most of the participants (92%) believed that vitamin D is important for health and (91.2%) of them have heard about vitamin D or vitamin D deficiency, the majority (91.5%) view it was a problem for women, children and elderly. Additionally, a minority of the respondents (29.1%) were aware of foods rich in vitamin D. Seventy-three point six percent suffered, at least, from one of the symptoms of vitamin D deficiency. Commonest symptom was unexplained fatigue and tiredness (24%), followed by muscle pain and weakness (20.9%) and hair loss (12%) (Table 2).

Table 2. Public's awareness, knowledge and attitudes toward vitamin D and sun exposure

Factor	Frequency (n)	Percentage (%)
Is vitamin D important for your health?		
Yes	851	92%
No	74	8%
Did you hear about vitamin D or vitamin D deficiency?		
Yes	842	91%
No	83	9%
Do you have any idea about foods rich in vitamin D?		
Yes	269	29.1%
No	656	70.9%
Do you suffer from symptoms of vitamin D deficiency?		
Fatigue and tiredness	222	24%
Muscle pain and weakness	193	20.9%
Hair loss	111	12%
Depression	71	7.7%,
Bone fractures and deformities	43	4.6%
	41	4.4%

Back and bone pain	244	26.4%
Feeling well		
Where do you think the body gets vitamin D from?		
Diet	135	14.6%
Sun exposure	514	55.6%
Supplements	91	9.8%
I don't know	185	20%
What is the most appropriate time of sun exposure?		
7 am-9 am	331	35.8%
9 am-11 pm	74	8%
1 pm-3 pm	85	9.2%
5 pm-7 pm	435	47%
What is the appropriate duration of sun exposure per day for adequate vitamin D status?		
<30 minutes	549	59.4%
30-60 minutes	238	25.7%
>60 minutes	94	10.2%
I don't know	44	4.7%
How much of vitamin D comes from the sun?		
10%	94	10.2%
25%	308	33.3%
50%	267	28.9%
90%	189	20.4%
I don't know	67	7.2%
Reason for no exposure		
Weather issues	549	59.3%
Social, cultural and religious issues	241	26%
Urbanization and lack of outdoors activities	94	10.3%
Health or physical issues	41	4.4%

Participants' attitudes toward sun exposure

Although a high proportion of participants (55.6%) recognized the sunlight as the main source of vitamin D, the majority of them (82.8%) did not recognize the best time of sun exposure. Fifty-nine point four percent of the respondents said that the appropriate duration of sun exposure for adequate vitamin D body need is less than 30 minutes. Ten point two percent said 10% of the vitamin D gained from the sun, while 33.3% and 28.9% said 25%, and 50% of the vitamin D gained from the sun respectively. Those who believed that exposure to sun can gave them 90% of their requirements of Vitamin D were only 20.4% of the total number of the respondents (Table 2).

When people were asked about the reasons behind no exposure to sunlight, the majority of the participants (59.3%) reported that they were not able to go outside and expose their bodies to sunlight due to hot weather. Twenty-six percent of the respondents said that the reason for no exposure was religious, social and cultural issues as the conservative dress of Saudi women i.e abaya with hijab and niqab considered to be as a key barrier to sunlight exposure in Saudi Arabia. Ten point three percent of the respondents said that urbanization and increased indoor lifestyle had played a major role as an obstacle in obtaining sufficient amount of direct sunlight. Four point four percent of the respondents said that they were not able to go outside and expose their bodies to sunlight due to sun-related health issues, such as feeling headache and dizziness upon exposure.

Participants' preference of using a vernacular window over a contemporary glass window

The findings described in Table 3 showed that the majority of the society in Madinah (77.4%) were dissatisfied with the level of daylight admitting into their homes. Sixty-three point three percent of the participants in Madinah used reflective glass with curtains for external window treatments at their homes. Although Rowshan was the least applied technique used by (3.2%) of the respondents, however, the majority (75.4%) of the participants believe in the ability of Rowshan, in compare with the current glass windows, to provide enough daylight level that is essential to maintain the physical and psychological health of the house occupants (Table 3).

Table 3. People's satisfaction with the different techniques used to maintain daylight at homes

Factor	Frequency (n)	Percentage (%)
Satisfaction with the level of daylight at homes		
Very satisfied	29	3.1%
Satisfied	178	19.2%
Dissatisfied	549	59.4%
Very dissatisfied	169	18.3%
Methods used for external window treatments to maintain daylight?		
Reflective glass with curtains	586	63.3%
Reflective glass with curtains and blackouts	187	20.2%
Reflective glass with movable shutters	69	7.5%
Rowshan	29	3.2%
Other techniques	54	5.8%

How aware are you of the socio-cultural, aesthetic and environmental features of Rowshan legacy?		
Very much	238	25.7%
A little	429	46.4%
Not at all	258	27.9%
Have you ever been to a place covered with Rowshan?		
Yes	638	69%
No	287	31%
In compared with the current glass windows, do you think Rowshan is providing more daylight into interior spaces?		
Strongly agree	258	27.9%
Agree	439	47.5%
Neutral	61	6.6%
Disagree	120	13%
Strongly disagree	47	5%
What are the reasons behind the decline practice of using Rowshan?		
High cost	279	30.5%
Difficult to clean	209	22.5%
Lack of craftsmen and manpower	186	20%
Reflect the old cultural values	120	13%
Lack of tight sealing and noise issue	47	5%
Obscure the view	37	4%
Long time required for construction	19	2%
Old-fashioned and not stylish	10	1.1%
Other	18	1.9%

The present study showed that only 72.1% of the participants were aware of the socio-cultural, aesthetic and environmental features of Rowshan legacy, which indicates a good level of knowledge. In addition, the majority of the public in Madinah (69%) had experienced being in a place covered with Rowshan. This indicates that the respondents gave answers based on their real experiences, not on their hypothetical opinions (Table 3).

Reasons behind erosion of Rowshan in contemporary buildings

The findings illustrated in Table 3 show that the reason (it is expensive) received the highest proportion (30.5%) of the responses, followed by the reason that (it is difficult to clean and provides access for insects and dust) with (22.5%) of the responses. Then, (20%) and (13%) of the respondents gave the reasons that (lack of craftsmen and manpower) and (it reflects the old cultural values); these were the reasons in third and fourth places respectively. Moreover, the reasons (lack of tight sealing, causing noise entering the house) and (it obscures the view) had almost same percentages of (5%) and (4%) of responses respectively. Then came the reason that (length of time required for construction) which received (2%) of responses, while (1.1%) of the respondents said (it is an old-fashioned and not stylish). However, (1.9%) of the respondents stated that there were other reasons behind their reluctance to use Rowshan in modern times (Table 3).

DISCUSSION

This study was conducted to assess the practice of the public of Madinah about vitamin D and their sun exposure. The results of this study showed that (55.6%) of the participants responded a valid answer regarding sun as a major source of vitamin D. Despite having good knowledge about sun exposure as a major source of vitamin D, a minority of the participants (17.2%) recognized the best time of sun exposure (which is 9 am-10.30 am and 1 pm-2 pm) (Babelghaith, 2017). In addition, only 10.2% recognized the appropriate duration of sun exposure for adequate vitamin D (which is 1-2 hours daily) (Babelghaith, 2017). These findings are in concordance with the results of Al-Agha et al study from Saudi Arabia who reported that 17.1% of the participants recognized the best time of sun exposure, while 5.7% knew the time of sun exposure required to get enough vitamin D (Al-Agha, 2016). Similarly, a cross-sectional survey conducted by Al Bathi et al in Kuwait revealed that less than one-fifth of their study participants were able to identify the best time of sun exposure as well as the appropriate duration of sun exposure for adequate vitamin D (Al Bathi, 2012).

Moreover, our study suggests that participants may not be completely aware of the foods rich in vitamin D; only (29.1%) of the participants had some idea about the richest dietary sources of vitamin D. This is in line with the study performed by Aljefree et al showing the majority of study participants had limited knowledge about the food sources of vitamin D (Aljefree, 2017). There are several studies from different parts of the kingdom demonstrating that the

lack of awareness and knowledge about vitamin D and sunlight exposure could be a major contributory factor for vitamin D deficiency (Al-Agha, 2016, Khan, 2017, Alshahrani, 2013).

Likewise, a study conducted in Netherlands has reported that the higher levels of knowledge about vitamin D were associated with the higher vitamin D serum levels among the participants (Norris, 2001). Our present study supports these findings and shows that there is a gap in the basic knowledge among the participants about the dietary sources of vitamin D and the ideal sunlight exposure which could be a major potential reason for the prevalence of vitamin D deficiency in Madinah despite a lot of sunshine (73.6% of the participants suffered from the symptoms of vitamin D deficiency). Furthermore, besides lack of knowledge about vitamin D and proper sunlight exposure, the prevalence of vitamin D deficiency in Madinah could be due to the constant hot temperature in the city which affects participants' attitudes and behaviors toward sun exposure. The majority of our study participants (59.3%) had negative attitudes toward sun exposure and reported that they were not able to go outside and expose their bodies to sunlight due to hot weather all year round. The same results were found in previous studies conducted in other parts of Saudi Arabia showing that the majority of the participants considered hot climate as a key barrier to sunlight exposure (Mansour, 2012, Aljefree, 2017).

In addition, Saudi Arabia has unique religious and cultural principles for women dressing where women wear conservative cloths such as abaya, with hijab and niqab to cover themselves when they are outside the home. Wearing such clothes can affect the synthesis of vitamin D, as the skin is totally covered and not exposed to UVB rays, thereby making Saudi women are more susceptible and likely have a vitamin D deficiency than men as reported in several studies (Christie, 2011, Siddiqui, 2007, Al-Saleh, 2015). Furthermore, the reduction in outdoor leisure time that has accompanied urbanization in Saudi Arabia and the rise in office-based work has led to an increased lack of sunlight exposure. Therefore, lack of knowledge about vitamin D and sunlight exposure, cultural and religious practices and hot climate in Saudi Arabia in general, and in Madinah in particular, are considered to have a strong impact on receiving sufficient sun exposure among the population, thereby causing vitamin D deficiency.

The present study showed that although the majority of the participants were aware of the Rowshan legacy and believed in its ability to provide enough daylight interiors, however, only 3.2% of the participants used Rowshan in their homes. This unexpected situation may be attributed to several factors. High cost, difficulty to clean and lack of

craftsmen and manpower were the main reasons behind people's reluctance to use Rowshan at their homes, as these received the highest proportion of the responses (30.5%), (22.5%), and (20%) respectively. Our results are in agreement with the findings of Aljowder's study from Bahrain showing that people were reluctant to use Rowshan at their homes because it is difficult to clean (49.1%) and it is expensive (30.5%) (28). According to Aljowder's study, the average cost of standard Rowshan is quite high, especially if it is made of natural teak solid wood, as of one square meter Rowshan costs £215 (Aljawder, 2014). Almerbati from Bahrain also showed in her PhD study that the average cost of Rowshan screen is quite high. Based on the Bahraini market, one square meter of Rowshan made of teak solid wood can cost up to £1,557 (Almerbati, 2016).

As an alternative, reflective glass with curtains was chosen by a significant percentage of our study participants (63.3%) for external window treatments (Figure 2). Although the option of using reflective glass seems to be cheaper, contemporary and practical solution for people, it may not be a sustainable solution for the environment (Figure 2). It has a highly reflective surface which reflects the light (causing glare) and reflects the long-wave infrared radiation that increases the external environment's temperature and that of neighbouring buildings (28). Furthermore, there is a consensus in the published literature that the use of reflective glass windows in residential buildings blocks UVB radiation that produces vitamin D, from entering the space (Neer, 1971, Gorgos, 2006).

So if the occupants open the glass window in order to get benefit from direct sunlight, hot air will also enter the room. This would then increase the inner temperature of the room. Additionally, opening the glass window would minimize the level of privacy within the house. According to Mahmud, privacy is paramount in the design of housing for occupants ascribing to Muslim culture. In this culture, privacy, especially for women is extremely imperative (Mahmud, 2009). However, in the case of Rowshan, the sunlight could still enter the room's interior and reach the occupants whilst still preserving their privacy.



Figure 2. Different techniques used to maintain daylight at homes in Madinah

CONCLUSIONS

In conclusion, our findings, confirm some previous evidence demonstrating that vitamin D insufficiency is highly prevalent in Madinah area of Saudi Arabia despite abundant sunlight year-round. Lack of knowledge about vitamin D and sunlight exposure, cultural and religious practices, hot climate and urbanization and increased indoor lifestyle are considered to play a major role as obstacles in obtaining sufficient amount of direct sunlight, thereby causing vitamin D deficiency among the general population in Madinah. At homes, people of Madinah are still believing in the ability of a traditional window such as Rowshan over a contemporary glass window in term of admitting high level of daylight interiors. However, there are three major drawbacks make Rowshan incompatible with contemporary Madani architecture and society. These are high cost, difficulty to clean and lack of craftsmen and manpower. We believe that if these drawbacks are overcome, people may rethink of using Rowsahn at their homes.

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