Available online at www.sciencedirect.com

ScienceDirect

Energy Procedia 134 (2017) 894–903

Procedia Engineering

www.elsevier.com/locate/procedia

9th International Conference on Sustainability in Energy and Buildings, SEB-17, 5-7 July 2017, Chania, Crete, Greece

Sunlight analysis for the Kuwaiti Government dwelling design and effects on householders' health

Mohammad Alhazim[a]*, John Littlewood[a], Keireine Canavan[b], Penny Carey[c]

[a]*The Ecological Built Environment Reseaech & Enterprise Group,*
[b]*Digital Textiles Research Theme (DIGIT)*
Cardiff Metropolitan University, Cardiff School of Art & Design,
Cardiff, CF5 2YB, UK.
[c]*Portakabin Limited*
New Lane, Hunington, York
YO32 9PT, UK

Abstract

This paper discusses access to sunlight and daylight in contemporary Kuwaiti Government dwellings. Prevalence of vitamin D deficiency among the Kuwaiti population is related to a lack of exposure to sunlight radiation. Householders' of the contemporary Kuwaiti Government dwellings in Al-Nahda town in Kuwait have been selected as a case study for the research project. Householders' were interviewed about sunlight access into their dwelling and health issues associated with living in the dwelling. The research project includes a new design for the Kuwaiti Government dwellings, which has been analysed for sunlight and daylight access as related to Al-Nahda town location in Kuwait.

Peer-review under responsibility of KES International.

Keywords: Sunlight; daylight; vitamin D; contemporary; dwelling; householders';

1. Introduction

The State of Kuwait has an abundance of sunshine year-round. The average sunlight and daylight per year is 4383 hours, which averages to 12 hours of sunlight and daylight per day. This is divided into an average of 3347 hours (76%) of sunlight per year, or 9 hours of sunlight per day. The remaining 1036 hours (24%) is daylight per year, or 3 hours of daylight per day which is likely present with cloud, shade, haze, or low sun intensity [1].

* Corresponding author.
E-mail address: moalhazim@cardiffmet.ac.uk

1876-6102
Peer-review under responsibility of KES International.
10.1016/j.egypro.2017.12.492

In contrast, in the UK the average of sunlight and daylight per year is 4383 hours, which averages to 12 hours of sunlight and daylight per day. This is divided into an average of 1460 hours (33%) of sunlight per year, or 4 hours of sunlight per day. And the remaining 2923 hours (67%) is daylight per year, or 8 hours of daylight per day which is likely present with cloud, shade, haze, or low sun intensity [2]. This illustrates that the average sunlight hours in Kuwait is more than double that of the UK. However, in 2017 a few studies estimated that nearly 100% of the Kuwaiti population suffers from lack of vitamin D [3 and 4], but only about 40% of the UK population suffers from vitamin D deficiency [5]. Despite the tremendous availability of sunlight in Kuwait compared with the UK, the percentage of vitamin D deficiency in the Kuwaiti population is more than double that of the UK population. The high percentage of vitamin D deficiency in the Kuwaiti population is likely related to the custom of covering the body, particularly with women, for local cultural and religion reasons.

In Kuwait, the household dwelling is the main place where householders' can uncover their body for personal comfort. Also, as dictated by Kuwaiti culture, this is where women spend the majority of their time. Hence, the dwelling is considered to be the only place where householders' can get exposure to sunlight. Before the introduction of western architecture almost 60 years ago, a traditional Kuwaiti house was designed to ensure private places for the householders' to get exposure to adequate sunlight. This resulted from a house design that focused inward on a courtyard, which provided complete privacy for the householders' (see Figure 1 below) [6 and 7]. In 2013, at the Mediterranean Green Energy Forum in Morocco, a conference paper was presented titled "Design Philosophy of the traditional Kuwaiti house". This paper explored in depth the differences between the traditional Kuwaiti house and modern architecture. After 1954, the design of the typical Kuwaiti house began to transform from the inward-focused plan to an outward oriented plan. This shift occurred due to globalization and worldwide commercial exchange, especially with western countries following the discovery of oil in Kuwait in 1938 [8 and 9]. The transformation to the outward-oriented plan in contemporary Kuwaiti house design has impeded the privacy of the householders' because of the outward-facing windows, which requires the shuttering of windows most of the day, preventing access to sunlight (see Figure 2 below). Consequently, the householders' lack of exposure to sunlight has resulted in a prevalence of vitamin D deficiency among the Kuwaiti population [10 and 11].

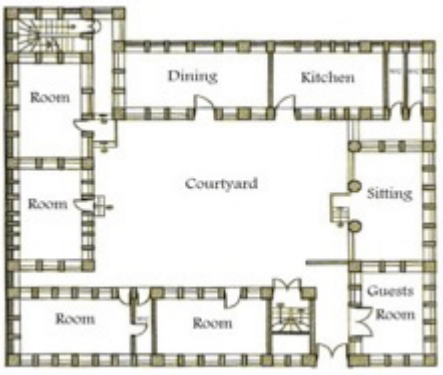

Figure 1: Inward plan of traditional Kuwaiti house (By researcher).

Figure 2: Outward plan of contemporary Kuwaiti Government dwelling (By researcher).

House design is a major contributor to human wellbeing, especially regarding space and sunlight. As urban living increases population density, there is a greater need for free space for movement, children's play, and for the flow of light and air [12]. Stagnant air and the absence of sufficient sunlight has adverse health implications on the growth of children and the wellbeing of adults. A house's green space provides an area for physical exercise, recreation, and family social interaction [13]. This paper includes a new design for the Kuwaiti Government dwelling that aims to avoid the issues identified by householders' regarding privacy and access to sunlight and daylight, which are presented by contemporary Kuwaiti Government dwelling design. The new design addresses the householders' feedback and requirements and is also compatible with an ecological design approach. The new design has been analysed for access to sunlight and daylight during summer and winter based on Al-Nahda town location in Kuwait. The results of this analysis demonstrate the new design advantages and disadvantages, and identify frameworks related to development of the new design.