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Thermal Comfort and Health of Older People During COVID-19

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Abstract: The purpose of this research is to investigate the effect of temperature differences in self-isolation conditions on the health and thermal comfort of the older people during the COVID-19 pandemic at home. In addition, it is the examination of the impact of lockdown at home on thermal awareness. In this study, two methods, transverse and longitudinal, were used for the field study of thermal comfort. The transverse study is a survey study with a sample size of 121. The longitudinal study includes a survey study consisting of 419 data obtained from 2 people during the COVID-19 outbreak in the summer of 2020. As a result of the research, it was seen that temperature changes negatively affect the comfort of the older people. Another finding is that when the participants spend a long time in the same environment, their thermal awareness increases.

Keywords: Thermal Comfort, thermal awareness, older people, lockdown

1. Introduction

Outbreaks that occur unexpectedly and threaten human health all over the world cause people to change their lifestyles, social environments and structures (Roaf, 2020). Well-designed living spaces should be able to adapt to the changes that will occur in extraordinary situations. Failure to provide a comfortable living space to the user may cause physical and psychological problems. In such cases, the importance of thermal comfort, which is one of the focal points of this study, emerges.

Many previous studies have investigated the factors affecting the thermal comfort of the older people. However, there are not enough studies on the health and thermal comfort of the older people in pandemic conditions. Pandemic conditions such as COVID-19 cause people to spend much more time in their homes than usual, while at the same time giving people the opportunity to get to know their homes better and experience how comfortable their homes are against rising temperatures. For this reason, it is thought that this study will make an important contribution to the literature. In this thesis, the effects of self-isolation and lockdown conditions on the thermal comfort and health of the older people are investigated.

2. Literature review

2.1 Thermal comfort

As mentioned by Nicol and Humphreys (2002), it is important to define a "good indoor climate" as it will affect the energy consumption and sustainability of the building as well as providing a comfortable environment for the building occupants. Thermal comfort has been described differently by researchers. According to ASHRAE standard 55 and EN ISO 7730:2005 definition of thermal comfort is “a condition of mind which expresses satisfaction with the thermal environment”.

There are many factors, including environmental and individual factors, that affect thermal comfort conditions. Olgyay mentions that air temperature, radiation, air movement and humidity are climate factors that affect people's comfort (Olgyay,1992). De Dear and

Brager (2002) mention the effect of personal factor (activity and clothing) which is a second title in addition to environmental factors. Following this study, Auliciems and Szokolay (2007) add a third title that is "contributing factors (food and drink, acclimatization, body shape, subcutaneous fat, age and gender and state of health)".

2.2 Older people

According to ASHRAE, there is no thermal feeling difference between young and old people, and comfort is shaped by clothing and activity levels, but other studies show that there are differences in thermal feel among young people and the elderly (Hoof and Hensen, 2006, Hwang and Chen, 2010, Schellen et al., 2010). This difference in thermal sensitivity can vary depending on hot and cold ambient conditions (Forcada and Tejedor 2020). Inoue et al. (2016) 's study on hot and cold sensitivity shows that under both conditions, the elderly have lower thermal sensitivity than the young, and that women have higher thermal sensitivity than men.

There is a remarkable relationship between the comfort of the thermal environment and the health and well-being of the older people (Soebarto et al., 2020). In “the cardiovascular, respiratory, renal, endocrinometabolic, musculoskeletal, and innate immune systems”, which are effective in ensuring the adjustment of body temperature, disorders that may occur due to the effect of advanced age are expected to may affect the susceptibility of the elderly to temperature changes (Blatteis, 2012). On the other hand, thermal discomfort is an indicator that environmental conditions may affect human health (Nicol et al. 2012). These studies show that thermal discomfort can cause some diseases in the older people and the thermal sensitivity of the older people can also be affected by these diseases.

3. Methodology

Field studies of thermal comfort have been chosen as the methodology of this study. In order not to risk the health of the older people participants due to Covid-19, all stages of this field studies were followed online. This field studies were conducted between May 2020 and July 2020 with self-isolated older people in their homes. This study includes transverse and longitudinal questionnaires made with the participants. The negative effects of COVID-19 conditions on the user's health and thermal comfort were identified in these surveys. As a result of the surveys, statistical data were created using SPSS. In this way, it was aimed to verify the quantitative and qualitative data obtained with each other.

4. Analysis and results

The data collected in this section will be examined under two main headings as transverse and longitudinal studies, and the results of the two studies will be compared under a third heading.

4.1 Transverse study

Transverse study was completed online between 13 May and 2 July with 121 participants. All the answers obtained from the people who participated in this study were converted into statistical data using the SPSS program. According to the results, the number of male participants is 71 and the number of female participants is 50. In addition, although the age range of the participants is between 50 and over 70, the majority are between the ages of 51-60.

First, the participants were asked to estimate the temperature of their environment, and then the questions of thermal sensation, thermal preference, overall comfort and humidity level were asked. Answers were numbered from 1 to 7 using the seven-point scale method. All the results obtained were analyzed separately for Female and male participants.

In Figure 1, how the participants felt about the temperature of the environment and how they wanted it to be and their general comfort were compared according to cognitive indoor temperature. Looking at both graphs, it is seen that the participants have the same thermal sensation, thermal preference and overall comfort values at different temperatures, even though their temperature estimates vary between 8 and 40 degrees. The reason for this situation may be that the participants had difficulty in predicting the numerical equivalent of the temperatures they felt. In addition, it is observed that female participants feel more comfortable than male participants despite the temperature change.

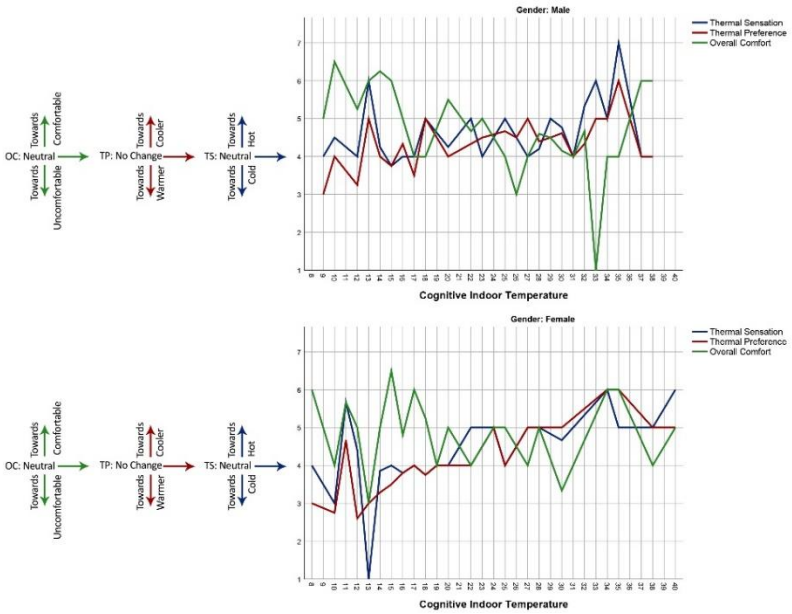

Figure 1. Thermal sensation, thermal preference, overall comfort by cognitive indoor temperature for gender

In Figure 2, the thermal sensation, humidity level and thermal comfort of the participants are compared. As in Figure 1, although the answers given at the same temperature vary, it is clearly seen that women are more sensitive to changes in the humidity level of the environment.

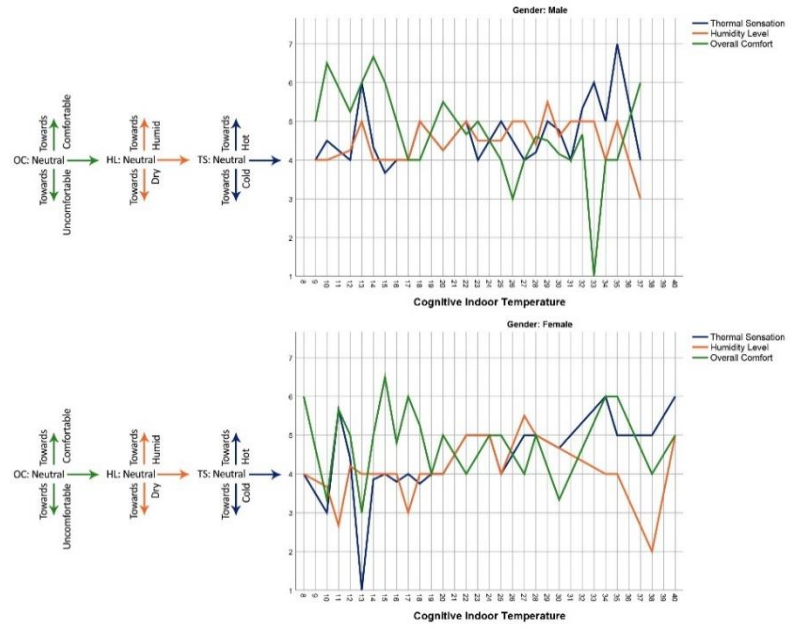

Figure 2. Thermal sensation, humidity level, overall comfort by cognitive indoor temperature for gender

4.2 Longitudinal Study

Longitudinal survey study took 57 days between 19/05/2020 - 14/07/2020. And this survey was filled in 4 times by repeating at certain times of the day, including morning, noon, evening and night. The most important detail in this study is that the participants only filled in the questionnaire during their stay at home. As a result of the survey study, a total of 419 responses were collected from 2 participants, 215 of which were male and 204 of which were female. In the longitudinal study, as in the transverse study, the answers to the thermal environment questions were numbered from 1 to 7 using the seven-point scale method and the responses of the two participants were analysed by classifying them according to gender. In addition, in this study, participants were asked to put a data logger in their homes. In this way, the temperature estimates of the participants were compared with the actual temperature data.

In Figure 3, the temperatures predicted by the participants are compared with the actual temperature of the environment. Although there was a difference between the temperature estimates and the actual temperature in the first days of the study for the two participants, this difference decreased significantly in the following days. The reason for this may be that the participants started to evaluate their thermal environment better as a result of continuing this study for a long time.

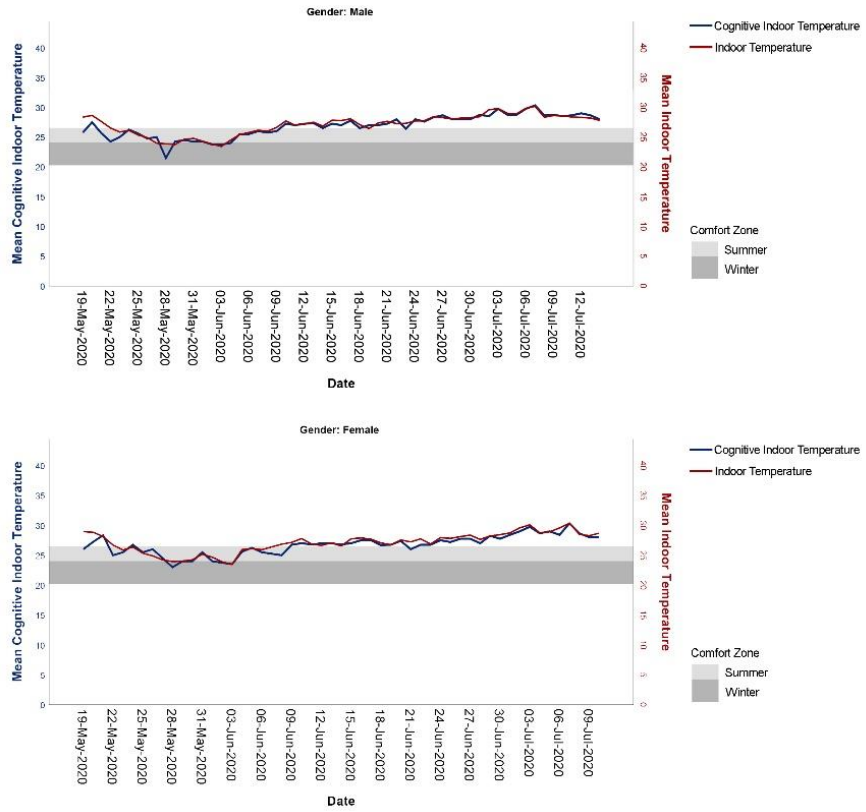

Figure 3. Cognitive indoor temperature and indoor temperature with ASHRAE Standard 55 comfort zone

Figure 4 shows the variation of the participants' thermal sensation, thermal preference and thermal comfort depending on temperature. It is seen that the responses of both participants generally change in direct proportion to the temperature. Although the female participant feels warmer than the male participant, she is mostly more comfortable than the

male participant. This may be due to other factors that affect thermal comfort other than temperature.

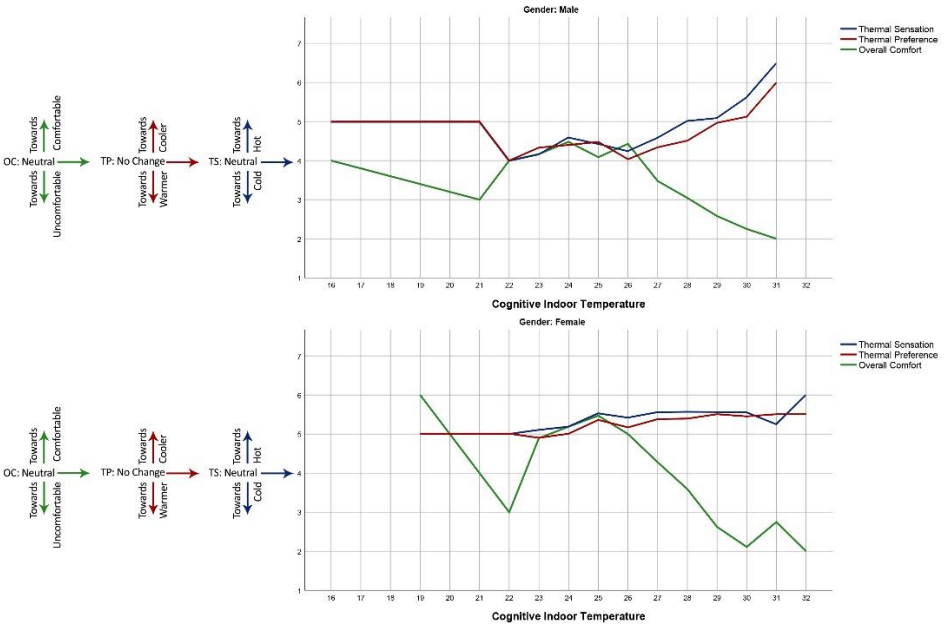

Figure 4. Thermal sensation, thermal preference, overall comfort by cognitive indoor temperature for gender

The answers given by the participants about the thermal sensation, thermal comfort and humidity level of the environment are compared in Figure 5. When looking at mean values about the humidity level for both participants, the male participant feels more humid than the female participant, despite being in the same environment.

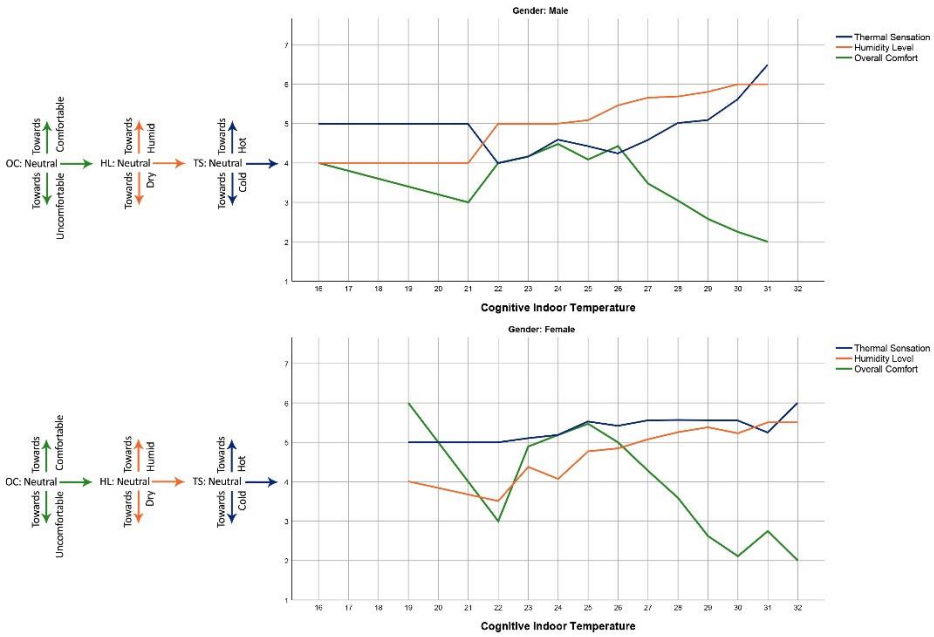

Figure 5. Thermal sensation, humidity level, overall comfort by cognitive indoor temperature for gender

4.3 Comparison: Transverse vs. longitudinal studies

The most important thing to consider in two studies is that participants in the transverse study participated in the questionnaire 1 time, while in the longitudinal study 2 participants

continued this study for about 60 days, 4 times a day. In addition, thanks to the data logger used in the longitudinal study, the sensed temperatures were compared with real data. Looking at the figures above in the two studies, it is clearly seen that the participants perceive the thermal environment better in the longitudinal study. The most important reason for this is that the study is carried out for a long time.

5. Conclusion

This study was conducted to investigate the thermal comfort and health of the older people during the COVID-19 outbreak. Considering the results of the study, it was determined that male and female participants have different thermal sensitivity at the same temperatures. Particularly in the longitudinal study, although the participants shared the same environment, their answers differed. In addition, it was clearly observed that the thermal awareness of the participants who had the chance to experience the environment they were in more increased due to the self-isolation and lockdown situation.

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