Nature Environment and Pollution Technology
An International Quarterly Scientific Journal

p-ISSN: 0972-6268
(Print copies up to 2016)
e-ISSN: 2395-3454

Vol. 22 | No. 2 | pp. 929-935 | 2023

Original Research Paper

https://doi.org/10.46488/NEPT.2023.v22i02.036

Open Access Journal

Visitors Perceptions of the Climate Comfort at the Padang Coastal Tourism Area, Indonesia

N. Y. Sudiar*(***)† and M. I. Gautama(***)**

*Physics Department, Universitas Negeri Padang, West Sumatra, Indonesia
**Sociology Department, Universitas Negeri Padang, West Sumatra, Indonesia
***Research Center for Climate Change, Universitas Negeri Padang, West Sumatra, Indonesia
†Corresponding author: N. Y. Sudiar; nysudiar@fmipa.unp.ac.id

Nat. Env. & Poll. Tech.
Website: www.neptjournal.com

Received: 28-08-2022
Revised: 18-10-2022
Accepted: 28-10-2022

Key Words:
Visitors perceptions
Climate comfort
Coastal tourism

ABSTRACT

This study explains visitors' perceptions of climate comfort in the Padang coastal tourism area, including Air Manis Beach, Padang Beach, Nirwana Beach, and Pasir Jambak Beach. Climate comfort index calculation using the Holiday Climate Index (HCI) and survey methods are used to take data. The survey is conducted to collect data on climate comfort perception and the role of weather on that comfort. There are 409 respondents in this study. Most visitors state that weather affects climate comfort during their trip (99%) and need weather information for outdoor tourism (98.5%). However, only 27.1% are looking for weather information before traveling outdoors. This coastal tourism area's perceived level of climate comfort is comfortable (64%). The thermal sensation is neutral (66%). Meanwhile, the average score of the comfort index in Padang is neutral throughout the year. The temperature interval indicates the comfortable category is between 26ºC-28ºC.

INTRODUCTION

As a strategic industry, the tourism sector must be managed professionally by considering various factors such as climate. Climate suitability has an impact on tourism destinations (Olya & Alipour 2015). The tourism industry is very sensitive to weather and climate (Li et al. 2016, Roshan et al. 2016) because these factors determine where tourists travel. Weather and climate are critical external factors influencing tourists' decision to visit an area (Priego et al. 2015, Rutty & Scott 2016). Therefore, climatic and weather conditions are important for tourism activities.

Moreover, some methods can be used to express comfort level, such as Tourism Climate Index (TCI), first introduced by Mieczkowski (1985). This method uses 5 weather parameters; air temperature, humidity, rainfall, sunshine, and wind speed (Ramazanipour & Behzadmoghaddam 2013). However, TCI has some weaknesses. It does not include the effects of longwave and shortwave radiation flux (Freitas & Scott 2007), subjective assessment, weighting system for climate variables, and low data resolution using monthly data (Scott et al. 2016). Thus, to cover the shortfall in TCI, Holiday Climate Index (HCI) method is introduced. The advantage of HCI compared to TCI lies in the rating scale of each climate component and the weight of each parameter (Scott et al. 2016).

Further, studies related to climate comfort for tourism areas in Indonesia are still very rare. Haryadi et al. (2019) used TCI to calculate the climate comfort index in Samosir Regency, North Sumatra. While Noor et al. (2018) used HCI to identify tourist comfort in the Banjarmasin area, South Kalimantan. Furthermore, Sudiar et al. (2019a) combined the two methods to determine the level of climate comfort in Ancol Eco-Park, Bogor Botanical Gardens, and Cibodas Botanical Gardens; in addition, using a special HCI method in tropical areas for the thermal aspect is underrated. According to the suggestion from our previous study, the use of the HCI method needs to be modified on the thermal aspect (Sudiar et al. 2019b). This study modified the thermal aspect rating to the highest scale (10 out of 10). The effective temperature was 25ºC-28ºC (Sudiar 2020), and the highest thermal rating for the HCI method was 23ºC-25ºC (Scott et al. 2016). For this reason, this study used the HCI method by modifying the thermal aspect so that a climate comfort level is suitable for tropical skin.

Furthermore, the determination of the comfort index based on climate variables was initiated by Mieczkowski

ORCID details of the authors:

N. Y. Sudiar: https://orcid.org/0000-0003-3921-4586
M. I. Gautama: https://orcid.org/0009-0003-1529-5526

(1985), known as the Tourism Climate Index (TCI), and it changed into the Holiday Climate Index (HCI) (Scott et al. 2016). HCI and TCI were consistently higher in Barcelona, Istanbul, Rome, London, Paris, and Stockholm (Scott et al. 2016). The results of using TCI in Northern Cyprus showed that precipitation harmed tourist comfort (Olya & Alipour 2015). The results of TCI use in North America showed that TCI could be widely used for determining the comfort of the tourism climate. However, the monthly period used needs to be replaced with a period more closely resembling the length of the general holiday period, such as 7-10 days (Scott & McBoyle 2001). On the other hand, TCI in Australia was used as a tool for optimal vacation spot identification and not as a predictor of travel (Amelung & Nicholls 2014).

However, studies on using TCI and HCI for tourism climate comfort are rarely done in Indonesia. Of the few studies, some of the studies are in Citeko West Java, Jatim Park 2, Karangkates, Samosir North Sumatra, Banjarmasin South Kalimantan, and our previous research in three natural tourism areas Eco-Park Ancol, Bogor Botanical Gardens, and Cibodas Botanical Gardens. The TCI score in Citeko, West Java, showed that the tourist area is more comfortable in the dry season than in the rainy season (Iftah 2015). The TCI and HCI score in Jatim Park 2 and Karangkates showed that HCI is better to use than TCI in tropical areas with relatively high rainfall and temperature (Kurnia 2016). The right time to visit Samosir based on TCI is February (Haryadi et al. 2019). This result is in contrast to that in Citeko, where the comfortable time is the dry season (June-July-August), while the best time to visit Samosir is in the rainy season (February). The HCI score in Banjarmasin is the dry season (Noor et al. 2018). The results of research at Eco-Park Ancol, Bogor Botanical Gardens, and Cibodas Botanical Gardens showed that HCI is more sensitive to use in tropical areas than TCI (Sudiar 2020). Furthermore, HCI needs to be modified in terms of thermal aspects because temperature variations in Indonesia throughout the year are very small (Sudiar et al. 2019a).

MATERIALS AND METHODS

The study area of this research was located in the coastal area of Padang City, West Sumatra, Indonesia, such as Air Manis Beach, Padang Beach, Nirwana Beach, and Pasir Jambak Beach. These areas were chosen because the four areas were always crowded with tourists. The method used was climate comfort index calculation using HCI and surveys. The survey conducted at tourist sites aimed to avoid bias because the observation stations for measuring weather parameters were not located at tourist sites.

The data calculation was taken from two Meteorology, Climatology, and Geophysics Agency (BMKG) observation stations, the Minangkabau International Airport (BIM) and the Maritime Meteorology, Teluk Bayur. The climate data used was air temperature, humidity, rainfall, sunshine, and wind speed during 10 years (2011-2020). The data used for the survey was direct measurements of air temperature, humidity, and wind speed at tourist sites using an anemometer with the type of Lutron model ABH-4224 which complied with ISO 9001 standard.

Table 1: Component of Holiday Climate Index (HCI).

Aspect	Climate Variable	Index Weighting [%]	
		Urban	Beach
Thermal	Maximum temperature [°C]	40	30
	Mean Relative humidity [%]		
Aesthetic	Cloud Cover [%]	20	35
Physics	Daily rainfall (mm)	30	25
	Wind Velocity (km/hour)	10	10

The HCI weighting was designed based on the survey results, and the largest score did not emphasize temperature (Table 1).

The HCI score was then calculated based on the climate variables score used with the following equation:

$$\text{HCI urban} = (TC\times4)+(A\times2)+[(P\times3)+(W\times1)] \quad \ldots(1)$$

$$\text{HCI beach} = (TC\times3)+(A\times3.5)+[(P\times2.5)+(W\times1)] \quad \ldots(2)$$

TC is thermal comfort with the weather parameters temperature and humidity. A is aesthetic with cloud cover weather parameters, and P is physical weather parameters with rainfall (P) and wind speed (W). Since the objects of research were coastal areas, equation (2) was used to calculate the climate comfort index.

Then, interviews with 409 respondents were conducted to measure weather parameters. The survey was conducted from August-September 2021 using simple random sampling. The number of visitors at Air Manis Beach, Padang Beach, Nirwana Beach, and Pasir Jambak Beach was considered to be more than 100 thousand people per month (Maswar 2017), so the Slovin formula was used to determine the sample size as follows:

$$n = N/(1+Ne\text{^}2) \quad \ldots(3)$$

n was the minimum sample size, N was the population size, and e was the margin of error. Based on equation (3), the minimum sample for an error of 5% was 385 people.

Next, convert the temperature measurement to the effective temperature using the following equation (Blazejczyk et al. 2012):

$$ET = 37 - \frac{37-T}{0{,}68-0{,}0014\cdot RH+\frac{1}{1{,}76+1{,}4\cdot v^{0{,}75}}} - 0{,}29\cdot T\cdot(1-0{,}01\cdot RH) \quad \ldots(4)$$

ET was the effective temperature, T was the measurement temperature, RH was the relative humidity, and v was the wind velocity.

The resulting comfort level gained from calculating historical data was verified through survey results. The data transformation method was used from ordinal to interval, Method of Succesive Intervals (MSI). MSI is the process of converting ordinal data (very uncomfortable, uncomfortable, neutral, comfortable, and very comfortable) into interval data (Ningsih et al. 2019). Since the statistical process required quantitative data, qualitative data (ordinal data) must be changed into quantitative (interval).

RESULTS AND DISCUSSION

Visitor Profile

In this study, the sample of visitors was slightly more dominated by men (50.6%) than women (49.4%). Most of the visitors were late teens (17-25 years) and early adults (26-35 years) (Al Amin & Dwi 2017), with 50.4% and 31.5%, respectively. The visitors with high school education or equivalent were dominant (58.4%) and undergraduate education (29.8%). Most visitors to this beach tourism area were local tourists who lived in Padang (62.8%) (Fig. 1). 409 visitors were willing to be interviewed, most of whom were young. It means that young people were more concerned about climate comfort than older people.

Visitor Perceptions of Comfort

Through closed questions, the respondents were asked several things about tourist comfort at tourist sites related to weather parameters such as air temperature, humidity, wind speed, and sunlight. The first question was whether the clothes worn when visiting tourist sites were decided after taking into account the weather factor. Most visitors answered that they only considered the air temperature (58.9%) and sunshine (60.6%). There were 34% who did not consider the weather factor at all. In fact, as a form of body adaptation to temperature, choosing clothes that suit the environment was important. By choosing suitable clothes, visitors would still feel comfortable at the tourist location. Furthermore, they were asked while visiting tourist sites did they consider the weather factor. Most visitors answered that they only considered the air temperature (65.3%) and wind (66.7%). Meanwhile, 26.4% said they did not consider the weather factor.

The next question was whether the weather was an important factor they consider when doing outdoor tours. The majority (98.8%) answered "Yes." The next question was whether the weather affected comfort. The majority (99%) answered "Yes." Furthermore, they were asked whether every outdoor tourism location needed to add climate comfort information. The majority (98.5%) answered Yes. Surprisingly, when they were asked whether they first look for weather information before visiting tourist sites or not, a total of 72.9% answered, "No" (Fig. 2). Based on the answers given by the visitors, it can be concluded that weather parameters were an important factor in terms of travel comfort, especially outdoor tourism. But unfortunately, the majority of them still did not take advantage of weather information in making decisions to travel. One of the reasons was that the tourist area did not prioritize weather information, which resulted in a high volume of tourists.

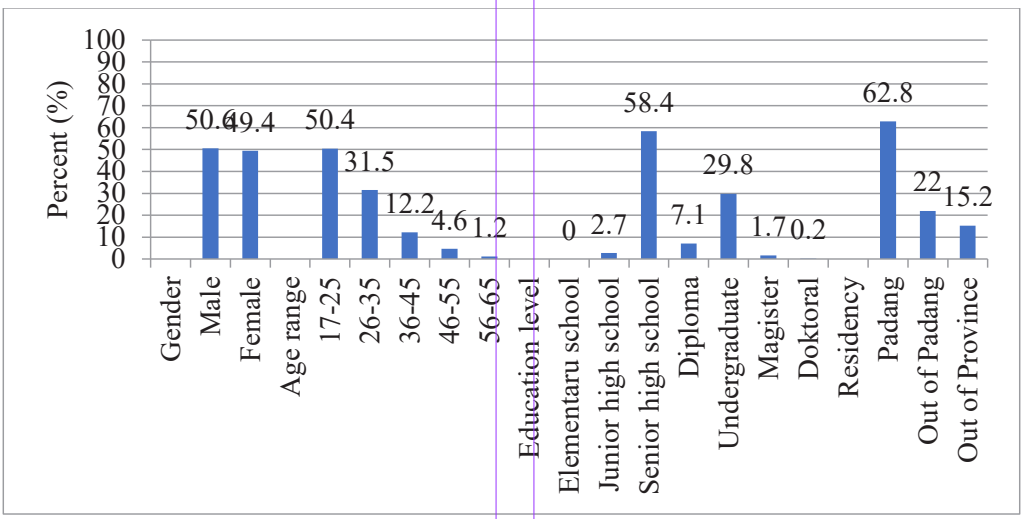

Fig. 1: Profile of visitors in the coastal tourism area of Padang.

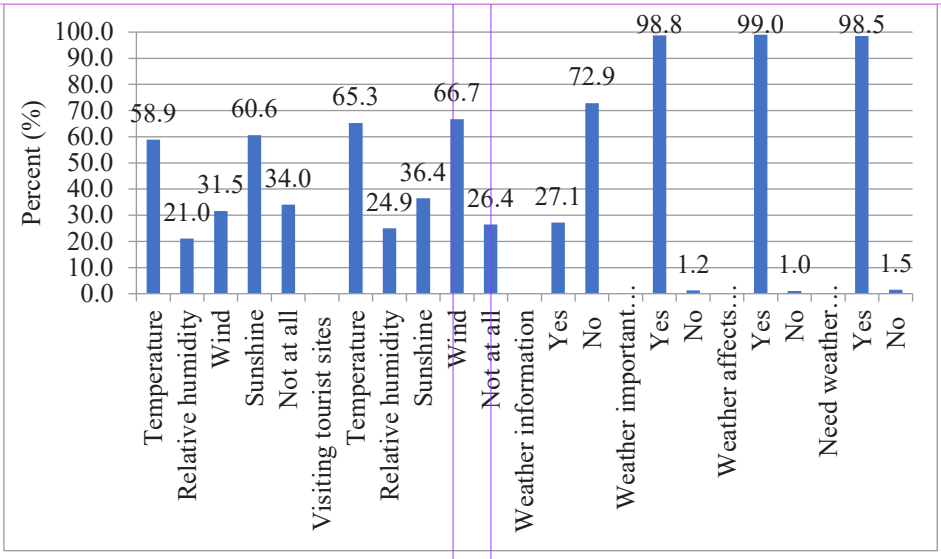

Fig. 2: Visitors' perceptions of tourist comfort based on climate parameters.

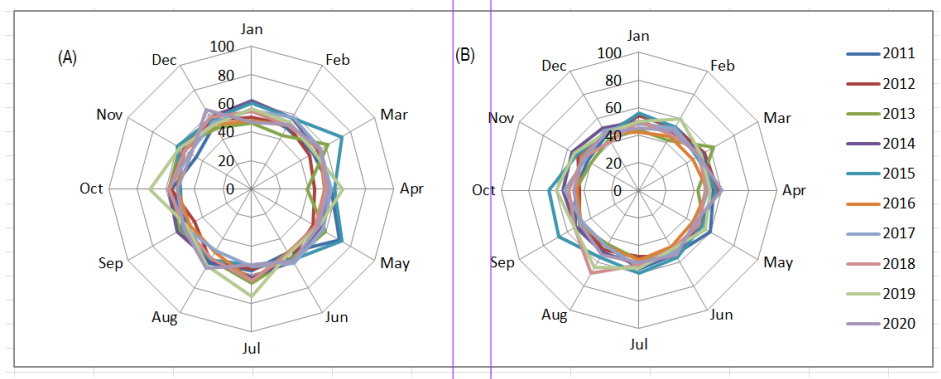

Fig. 3: Climate comfort score for 10 years (A) BIM Station and (B) Teluk Bayur Station.

Climate Comfort Score

The climate comfort score was calculated using equation (2). The optimal effective temperature (comfortable) in the thermal aspect of the HCI method was 23°C-25°C (Scott et al. 2016). This thermal aspect needed to be modified because the temperature variations throughout the year in the tropical area were not the same as in the sub-tropical and temperate areas. Research conducted in Dhaka, which has a tropical hot-humid climate, showed that the range of comfortable outdoor conditions using the PET method was 29.5°C-32.5°C (Sharmin et al. 2019). Meanwhile, research conducted in Kuala Lumpur showed that comfortable outdoor conditions also using the PET method obtained 25.6°C (Aghamohammadi et al. 2021). Our previous research found that the highest thermal rating was an effective temperature of 25ºC-28ºC (Sudiar 2020). These results were used to modify the thermal aspect to calculate the climate comfort score in the coastal tourism area of Padang.

To determine the climate comfort score in Padang, we used historical data from 2011-2020 (10 years) from two BMKG stations. We did this because there were no weather stations at tourist sites. The results of these calculations can be seen in Fig. 3 that the average year-round climate comfort score in Padang was neutral (Table 2). A comfortable climate was an HCI score of ≥ 60, a neutral score of 40 to 59, and an uncomfortable score of < 40 (Ramazanipour & Behzadmoghaddam 2013, Scott et al. 2016). These results provided an overview of the general conditions of climate comfort in Padang that was not specifically for coastal tourism areas. Calculation of comfort scores in coastal tourist areas must be done by directly measuring weather parameters such as air temperature, humidity, and wind velocity.

Table 2: HCI score.

ttScore	Category	Information
100-90	Ideal	Very Comfortable
89-80	Excellent	
79-70	Very Good	Comfortable
69-60	Good	
59-50	Acceptable	Neutral
49-40	Marginal	
39-30	Unfavorable	Uncomfortable
29-20	Very unfavorable	
19-10	Extremely Unfavorable	Very Uncomfortable
9-0	Impossible	

Visitor Comfort Level

Visitors were given closed-ended questions to obtain information about the range of comfort levels they felt based on weather parameters. The answer categories were very uncomfortable, uncomfortable, neutral, and comfortable. The comfort level calculation was carried out using MSI. The results of the interviews showed that the overall level of comfort in the coastal tourism area of Padang was comfortable (64%) (Fig. 4).

In addition to asking about the comfort level, this study also asked about the thermal sensation visitors feel. Thermal comfort was measured by involving air temperature, radiation temperature, air humidity, and airflow velocity (Mayer & Hoppe 1987). Thus, we can interpret the thermal sensation as a sensation the skin feels using weather parameters. The answer categories were 7 categories; very hot, hot, slightly hot, neutral, slightly cold, cold, and very cold. The results of interviews showed that the coastal tourism area of Padang had a neutral thermal sensation (66%) (Fig. 5). A study conducted in Kuala Lumpur found that 62% (n=243) stated a neutral thermal sensation at 25.6°C PET (Aghamohammadi et al. 2021).

When conducting interviews with respondents, air temperature, humidity, and wind speed measurements at tourist sites were also carried out. The measurements at tourist sites showed that the air temperature interval was from 26.5ºC-33.8ºC. The air humidity interval was 58.9% - 81.2%, and the wind speed interval was 0.1 m/s-6.3 $m.s^{-1}$. The measurement results were converted to effective temperature because the temperature felt by the skin was the effective temperature. The average effective temperature was 27.5ºC (306 people). Furthermore, the average effective temperature in the neutral category was 28.2ºC (68 people). Next, the effective temperatures for uncomfortable, very comfortable, and very uncomfortable conditions were 28.9ºC (28 people), 26.8ºC (6 people), and 28.3ºC (1 person) (Fig. 5). To get the level of climate comfort in the coastal tourism area, the effective temperature was carried out by linear regression:

$$Y = -0{,}4299x + 29{,}234 \quad \ldots(5)$$

With $R^2 = 0.7201$. From equation (5), the comfortable interval was the effective temperature between 26ºC - 28ºC. Interestingly, when the effective temperature was 28ºC, the sensation felt by visitors was a bit hot (Fig. 5). Although

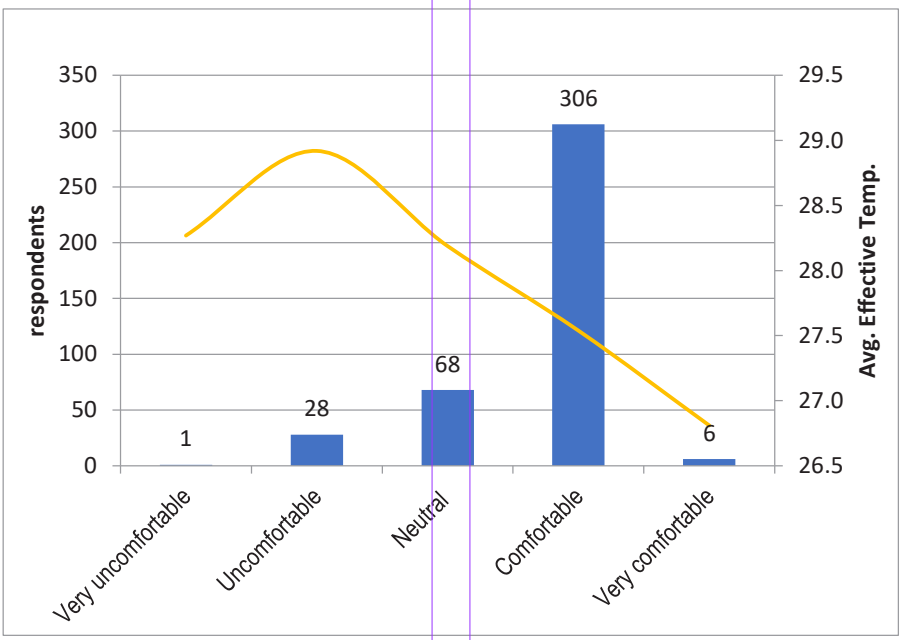

Fig. 4: The level of comfort felt by visitors in the coastal tourism area of Padang City.

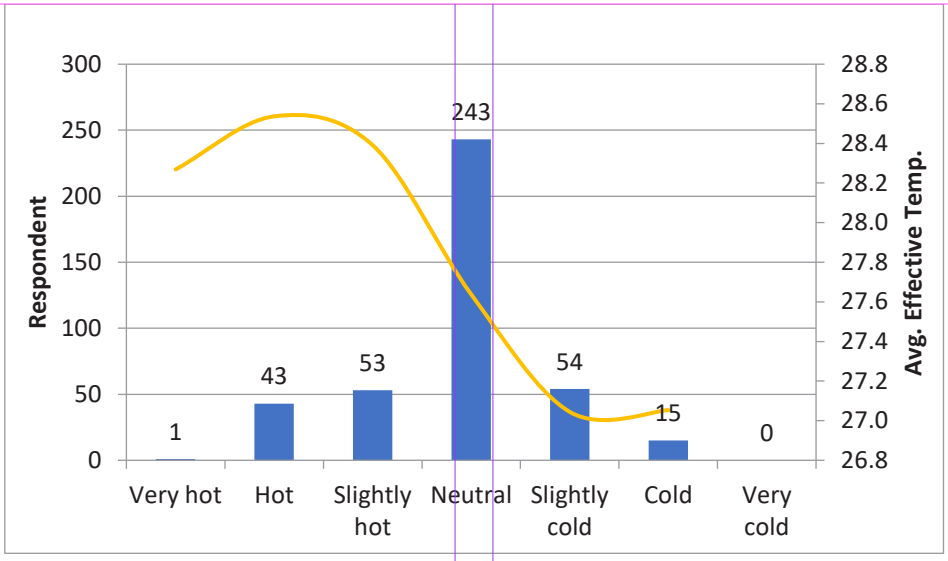

Fig. 5: Thermal sensation felt by visitors in the coastal area of Padang.

they felt a slightly hot sensation, they still categorized the condition as comfortable. This indicated that although the air temperature in the coastal area was high, the sensation felt by the body remained comfortable because the wind was blowing quite hard.

The results of the effective temperature obtained in this study were slightly different from the previous results. Previous research was conducted in three locations with diverse topography, from coastal to mountainous. On the contrary, this research specialized in the coastal area. This difference further confirmed that climate comfort also depended on the variable of residence. In Dhaka and Kuala Lumpur, the neutral thermal sensation is 29.5C-32.5C and 25.6C, respectively (Sharmin et al. 2019, Aghamohammadi et al. 2021). Singapore's acceptable operating temperature interval was 26.3ºC-31.7ºC (Yang et al. 2013). In determining the operating temperature, it was important to consider how air temperature, average radiation temperature, and wind speed affected a person's thermal comfort (Hwang et al. 2010). Most visitors who lived in the coastal area, of course, had adapted to these environmental conditions.

CONCLUSION

The visitors considered that the weather was an important factor to consider for outdoor tourism activities. Young people (late teens and early adults) were more concerned with climate comfort for outdoor tourism than older people. The HCI method found that Padang's average year-round climate comfort score was neutral. The interviews with visitors showed that the overall level of comfort in the coastal tourism area of Padang was comfortable. Furthermore, the comfortable interval felt by visitors was the effective temperature between 26ºC-28ºC, and the perceived thermal sensation was neutral.

ACKNOWLEDGMENTS

The authors would like to thank Lembaga Penelitian dan Pengabdian Masyarakat Universitas Negeri Padang for funding this work with contract number: 874/UN35.13/LT/2021.

REFERENCES

Aghamohammadi, N., Saun, F.C., Mohd Idrus, M.H., Ramakreshnan, L., Haque, U. and Haque, U. 2021. Outdoor thermal comfort and somatic symptoms among students in a tropical city. Sustain. Cities Soc., 72: 103015. https://doi.org/10.1016/j.scs.2021.103015.

Al Amin, A.N. and Dwi, J. 2017. Classification of human age based on box-counting fractal dimensional analysis of facial images with canny edge detection. Sci. J. Math., 2(6): 33-42.

Amelung, B. and Nicholls, S. 2014. Implications of climate change for tourism in Australia. Tour. Manag., 41: 228-244. http://doi.org/10.1016/j.tourman.2013.10.002.

Blazejczyk, K., Epstein, Y., Jendritzky, G., Staiger, H. and Tinz, B. 2012. Comparison of UTCI to selected thermal indices. Int. J. Biometeorol., 56: 515-535. Doi: 10.1007/s00484-011-0453-2.

Freitas, C.R.D. and Scott, D. 2007. Assessment method for climate and tourism based on daily. Tourism,11: 52-58.

Haryadi, A., Kusratmoko, E. and Karsidi, A. 2019. Climate comfort analysis for tourism in Samosir district. E3S Web Conf., 94: 5001. https://doi.org/10.1051/e3sconf/20199405001.

Hwang, R.L., Lin, T.P., Cheng, M.J. and Lo, J.H. 2010. Adaptive comfort model for tree-shaded outdoors in Taiwan. Build. Environ., 45(8): 1873-1879. doi:10.1016/j.buildenv.2010.02.021

Iftah, V.R. 2015. Analysis of the climate index of the tourism sector in Citeko, West Java. Thesis. IPB University, Bogor.

Kurnia, R.F.A. 2016. Analysis of Climate Comfort Index: Case Study:

Taman Wisata Jatim Park 2 and Karangkates. Thesis. IPB University, Bogor.

Li, H., Song, H. and Li, L. 2016. A Dynamic panel data analysis of climate and tourism demand: Additional Evidence. J. Travel Res., 56: 158-171. https://doi.org/10.1177/0047287515626304.

Maswar, D. 2017. Investment opportunities for the Development of the Padang beach area. DPMPTSP, West Sumatra.

Mayer, H. and Hoppe, P. 1987. Thermal comfort of man in different urban environments. Theor. Appl. Climatol., 38: 43-49.

Mieczkowski, Z. 1985. The tourism climatic index: a method of evaluating world climates for tourism. Canadian Geographer/Le Géographe Canadien, 29(3): 220-233.

Noor, A.B.S., Rakhmat, D.I., Khasanah, S.N. and Kurniawan, W. 2018. Utilization of holiday climate index (HCI) information in the tourism sector: Case study: Banjarmasin City. Appl. Res., 54: 616-628

Olya, H.G.T. and Alipour, H. 2015. Risk assessment of precipitation and the tourism climate index. Tour. Manag., 50: 73-80. http://doi.org/10.1016/j.tourman.2015.01.010.

Priego, F.J., Rosselló, J. and Santana-Gallego, M. 2015. The impact of climate change on domestic tourism: A gravity model for Spain. Reg. Environ. Change, 15: 291-300. https://doi.org/10.1007/s10113-014-0645-5.

Ramazanipour, M. and Behzadmoghaddam, E. 2013. Analysis of tourism climate index of Chaloos city. Int. J. Human. Manag. Sci., 1(5): 2320-2324.

Roshan, G., Yousefi, R. and Fitchett, J.M. 2016. Long-term trends in tourism climate index scores for 40 stations across Iran: The role of climate change and influence on tourism sustainability. Int. J. Biometeorol., 60: 33-52. https://doi.org/10.1007/s00484-015-1003-0.

Rutty, M. and Scott, D. 2016. Comparison of climate preferences for domestic and international beach holidays: A case study of Canadian travelers. Atmosphere, 7: 230. https://doi.org/10.3390/atmos7020030.

Scott, D. and McBoyle, G. 2001. Using a 'tourism climate index' to examine the implications of climate change for climate as a tourism resource. Int. Soc. Biometeorol., 11: 69-88.

Scott, D., Rutty, M., Amelung, B. and Tang, M. 2016. An inter-comparison of the holiday climate index (HCI) and the tourism climate index (TCI) in Europe. Atmosphere, 17: 25-36. Doi:10.3390/atmos7060080.

Setia, N. and Hendra, D. 2019. Application of interval successive method in multiple linear analysis. Jambura J. Math., 1: 43-53.

Sharmin, T., Steemers, K. and Humphreys, M. 2019. Outdoor thermal comfort and summer PET range: A field study in tropical city Dhaka. Energy Build., 198: 149-159. https://doi.org/10.1016/j.enbuild.2019.05.064.

Sudiar, N.Y. 2020. Climatological Comfort of Natural Tourism Areas in Indonesia. Dissertation. IPB University, Bogor.

Sudiar, N.Y., Koesmaryono, Y., Perdinan, P. and Arifin, H.S. 2019a. Characteristics and climate comfort of nature-based tourist sites in Ancol Eco-Park, Bogor Botanical Gardens, and Cibodas Botanical Gardens. Environ. Sci., 15: 240. https://doi.org/10.20527/es.v15i2.6967.

Sudiar, N.Y., Koesmaryono, Y., Perdinan, P. and Arifin, H.S. 2019b. Studies of thermal comfort in the Jakarta north coast tourism region of Indonesia. Int. J. Adv. Res., 7(9): 476-483.

Yang, W., Wong, N.H. and Jusuf, S.K. 2013. Thermal comfort in outdoor urban spaces in Singapore. Build. Environ., 59: 426-435. doi:10.1016/j.buildenv.2012.09.008.