Sunan Kalijaga Journal of Applied Mathematics ISSN 2987-0518 (print)
April 2023, Vol. 1, No. 1, 1 – 10 ISSN 2987-050X (online)

STATISTICAL DATA OF COMFORT LEVEL PROVINCE OF DAERAH ISTIMEWA YOGYAKARTA, INDONESIA

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Abstract

Daerah Istimewa Yogyakarta is one of the provinces in Indonesia. The criteria for comfort in the Daerah Istimewa Yogyakarta at 13.00 have been very uncomfortable. The criteria for comfort in the Daerah Istimewa Yogyakarta several times at 10.00 and 16.00 were uncomfortable. The criteria for comfort are comfortable at 13.00 because it is raining, which makes the criteria comfortable.

Keywords: Comfort Criteria; Daerah Istimewa Yogyakarta; Very Uncomfortable.

1. INTRODUCTION

Comfort is a person's assessment of his environment (Bun et.al., 2018). A person's assessment of the environment is based on the stimuli that enter him. A person's comfort is influenced by various factors, such as temperature, humidity, wind speed and others. The level of comfort can be calculated using the Temperature-Humidity Index (THI) method, which is influenced by temperature and humidity (Gantner et al., 2011). Daerah Istimewa Yogyakarta (DIY) is one of the provinces in Indonesia. DIY has an area of 3,185.80 km^2 and a population in 2021 as many as 3,677,446 people (Jogjaprov, 2022).

Figure 1. Yogyakarta International Airport

Figure 2. UIN Sunan Kalijaga Yogyakarta

2. COMFORT LEVEL OF DAERAH ISTIMEWA YOGYAKARTA

Temperature-Humidity Index (THI) using the equation

$$THI = 0.8T + (RH \times T)/500 \quad (1)$$

where T = Temperature in units ˚C, RH = Relative Humidity dalam persen. The THI criteria are in Table 1.

Table 1. Criteria for Temperature Humidity Index (THI)

No	Criteria THI	Comfort Level
1	THI < 29	Comfort
2	29 < THI < 30.5	Discomfort
3	THI > 30.5	Very Discomfort

Source: Supriatna et.al. (2016)

In this study we use secondary data, namely Timeanddate (2022). Table 2 is data on temperature, humidity on September 7, 2022 – October 9, 2022 in DIY.

Table 2. Temperature and Humidity on September 7, 2022 – October 9, 2022 in DIY

No	Date	O'clock	Temperature (˚C)	Humidity (%)	THI	Criteria
1	7 September 2022	01.00	28	75	26.6	Comfort
		04.00	27	80	25.92	Comfort
		07.00	27	79	25.866	Comfort
		10.00	32	56	29.184	Discomfort
		13.00	34	48	30.464	Discomfort
		16.00	30	72	28.32	Comfort
		19.00	27	73	25.542	Comfort
		22.00	25	95	24.75	Comfort
2	8 September 2022	01.00	25	92	24.6	Comfort
		04.00	25	88	24.4	Comfort
		07.00	26	85	25.22	Comfort
		10.00	30	65	27.9	Comfort
		13.00	30	68	28.08	Comfort
		16.00	28	76	26.656	Comfort

No	Date	O'clock	Temperature (˚C)	Humidity (%)	THI	Criteria
		19.00	28	80	26.88	Comfort
		22.00	27	82	26.028	Comfort
3	9 September 2022	01.00	26	81	25.012	Comfort
		04.00	25	84	24.2	Comfort
		07.00	26	81	25.012	Comfort
		10.00	31	59	28.458	Comfort
		13.00	31	64	28.768	Comfort
		16.00	30	74	28.44	Comfort
		19.00	25	91	24.55	Comfort
		22.00	24	91	23.568	Comfort
4	10 September 2022	01.00	24	90	23.52	Comfort
		04.00	24	89	23.472	Comfort
		07.00	26	81	25.012	Comfort
		10.00	30	66	27.96	Comfort
		13.00	31	58	28.396	Comfort
		16.00	30	71	28.26	Comfort
		19.00	24	98	23.904	Comfort
		22.00	24	95	23.76	Comfort
5	11 September 2022	01.00	24	92	23.616	Comfort
		04.00	24	93	23.664	Comfort
		07.00	24	87	23.376	Comfort
		10.00	30	62	27.72	Comfort
		13.00	33	59	30.294	Discomfort
		16.00	30	71	28.26	Comfort
		19.00	26	89	25.428	Comfort
		22.00	27	81	25.974	Comfort
6	12 September 2022	01.00	26	81	25.012	Comfort
		04.00	26	88	25.376	Comfort
		07.00	28	77	26.712	Comfort
		10.00	31	61	28.582	Comfort
		13.00	33	50	29.7	Discomfort
		16.00	30	73	28.38	Comfort
		19.00	29	75	27.55	Comfort
		22.00	28	79	26.824	Comfort
7	13 September 2022	01.00	27	84	26.136	Comfort
		04.00	26	83	25.116	Comfort
		07.00	27	82	26.028	Comfort
		10.00	31	65	28.83	Comfort
		13.00	32	58	29.312	Comfort
		16.00	31	63	28.706	Comfort
		19.00	29	63	26.854	Comfort
		22.00	25	88	24.4	Comfort
8	14 September 2022	01.00	25	88	24.4	Comfort
		04.00	25	85	24.25	Comfort
		07.00	25	84	24.2	Comfort
		10.00	30	69	28.14	Comfort

No	Date	O'clock	Temperature (˚C)	Humidity (%)	THI	Criteria
		13.00	32	56	29.184	Discomfort
		16.00	31	61	28.582	Comfort
		19.00	29	69	27.202	Comfort
		22.00	28	72	26.432	Comfort
9	15 September 2022	01.00	27	74	25.596	Comfort
		04.00	26	84	25.168	Comfort
		07.00	26	81	25.012	Comfort
		10.00	30	58	27.48	Comfort
		13.00	33	54	29.964	Discomfort
		16.00	33	54	29.964	Discomfort
		19.00	24	94	23.712	Comfort
		22.00	26	88	25.376	Comfort
10	16 September 2022	01.00	26	90	25.48	Comfort
		04.00	26	86	25.272	Comfort
		07.00	26	83	25.116	Comfort
		10.00	32	52	28.928	Comfort
		13.00	34	45	30.26	Discomfort
		16.00	31	65	28.83	Comfort
		19.00	30	70	28.2	Comfort
		22.00	25	87	24.35	Comfort
11	17 September 2022	01.00	25	93	24.65	Comfort
		04.00	24	91	23.568	Comfort
		07.00	26	78	24.856	Comfort
		10.00	32	49	28.736	Comfort
		13.00	34	40	29.92	Discomfort
		16.00	32	64	29.696	Discomfort
		19.00	29	74	27.492	Comfort
		22.00	28	74	26.544	Comfort
12	18 September 2022	01.00	27	81	25.974	Comfort
		04.00	25	86	24.3	Comfort
		07.00	26	82	25.064	Comfort
		10.00	32	50	28.8	Comfort
		13.00	36	33	31.176	Very Discomfort
		16.00	34	58	31.144	Very Discomfort
		19.00	30	69	28.14	Comfort
		22.00	28	71	26.376	Comfort
13	19 September 2022	01.00	27	80	25.92	Comfort
		04.00	25	82	24.1	Comfort
		07.00	26	75	24.7	Comfort
		10.00	30	52	27.12	Comfort
		13.00	32	50	28.8	Comfort
		16.00	32	56	29.184	Discomfort
		19.00	30	67	28.02	Comfort
		22.00	25	85	24.25	Comfort

No	Date	O'clock	Temperature (˚C)	Humidity (%)	THI	Criteria
14	20 September 2022	01.00	26	85	25.22	Comfort
		04.00	25	86	24.3	Comfort
		07.00	26	82	25.064	Comfort
		10.00	30	65	27.9	Comfort
		13.00	32	54	29.056	Discomfort
		16.00	33	42	29.172	Discomfort
		19.00	30	64	27.84	Comfort
		22.00	29	70	27.26	Comfort
15	21 September 2022	01.00	27	72	25.488	Comfort
		04.00	26	76	24.752	Comfort
		07.00	26	76	24.752	Comfort
		10.00	31	61	28.582	Comfort
		13.00	32	62	29.568	Discomfort
		16.00	30	67	28.02	Comfort
		19.00	29	72	27.376	Comfort
		22.00	28	78	26.768	Comfort
16	22 September 2022	01.00	26	83	25.116	Comfort
		04.00	26	87	25.324	Comfort
		07.00	26	83	25.116	Comfort
		10.00	33	49	29.634	Discomfort
		13.00	34	49	30.532	Very Discomfort
		16.00	30	74	28.44	Comfort
		19.00	27	86	26.244	Comfort
		22.00	26	89	25.428	Comfort
17	23 September 2022	01.00	26	83	25.116	Comfort
		04.00	26	87	25.324	Comfort
		07.00	26	83	25.116	Comfort
		10.00	33	49	29.634	Discomfort
		13.00	34	49	30.532	Very Discomfort
		16.00	30	74	28.44	Comfort
		19.00	27	86	26.244	Comfort
		22.00	26	89	25.428	Comfort
18	24 September 2022	01.00	26	84	25.168	Comfort
		04.00	25	84	24.2	Comfort
		07.00	26	82	25.064	Comfort
		10.00	30	68	28.08	Comfort
		13.00	34	46	30.328	Discomfort
		16.00	31	68	29.016	Comfort
		19.00	27	70	25.38	Comfort
		22.00	26	78	24.856	Comfort
19	25 September 2022	01.00	25	84	24.2	Comfort
		04.00	25	86	24.3	Comfort
		07.00	26	78	24.856	Comfort
		10.00	33	45	29.37	Discomfort

No	Date	O'clock	Temperature (˚C)	Humidity (%)	THI	Criteria
		13.00	35	37	30.59	Very Discomfort
		16.00	35	37	30.59	Comfort
		19.00	30	70	28.2	Comfort
		22.00	29	65	26.97	Comfort
20	26 September 2022	01.00	28	78	26.768	Comfort
		04.00	26	82	25.064	Comfort
		07.00	27	79	25.866	Comfort
		10.00	31	59	28.458	Comfort
		13.00	33	53	29.898	Discomfort
		16.00	33	58	30.228	Discomfort
		19.00	30	57	27.42	Comfort
		22.00	27	67	25.218	Comfort
21	27 September 2022	01.00	28	78	26.768	Comfort
		04.00	26	82	25.064	Comfort
		07.00	27	79	25.866	Comfort
		10.00	32	45	28.48	Comfort
		13.00	35	39	30.73	Discomfort
		16.00	34	40	29.92	Discomfort
		19.00	30	68	28.08	Comfort
		22.00	28	66	26.096	Comfort
22	28 September 2022	01.00	27	75	25.65	Comfort
		04.00	25	81	24.05	Comfort
		07.00	27	78	25.812	Comfort
		10.00	32	48	28.672	Comfort
		13.00	34	38	29.784	Discomfort
		16.00	34	40	29.92	Discomfort
		19.00	30	65	27.9	Comfort
		22.00	28	72	26.432	Comfort
23	29 September 2022	01.00	27	74	25.596	Comfort
		04.00	27	78	25.812	Comfort
		07.00	27	78	25.812	Comfort
		10.00	32	44	28.416	Comfort
		13.00	34	40	29.92	Discomfort
		16.00	31	64	28.768	Comfort
		19.00	28	81	26.936	Comfort
		22.00	28	81	26.936	Comfort
24	30 September 2022	01.00	27	78	25.812	Comfort
		04.00	27	70	25.38	Comfort
		07.00	28	72	26.432	Comfort
		10.00	32	57	29.248	Discomfort
		13.00	33	55	30.03	Discomfort
		16.00	30	67	28.02	Comfort
		19.00	30	64	27.84	Comfort
		22.00	28	70	26.32	Comfort
25		01.00	27	75	25.65	Comfort

No	Date	O'clock	Temperature (˚C)	Humidity (%)	THI	Criteria
	1 October 2022	04.00	26	80	24.96	Comfort
		07.00	27	77	25.758	Comfort
		10.00	32	58	29.312	Discomfort
		13.00	33	56	30.096	Discomfort
		16.00	30	68	28.08	Comfort
		19.00	30	73	28.38	Comfort
		22.00	29	71	27.318	Comfort
26	2 October 2022	01.00	28	79	26.824	Comfort
		04.00	27	84	26.136	Comfort
		07.00	27	80	25.92	Comfort
		10.00	31	66	28.892	Comfort
		13.00	32	56	29.184	Discomfort
		16.00	31	63	28.706	Comfort
		19.00	29	76	27.608	Comfort
		22.00	28	75	26.6	Comfort
27	3 October 2022	01.00	27	81	25.974	Comfort
		04.00	26	80	24.96	Comfort
		07.00	27	80	25.92	Comfort
		10.00	30	67	28.02	Comfort
		13.00	31	62	28.644	Comfort
		16.00	30	70	28.2	Comfort
		19.00	27	80	25.92	Comfort
		22.00	28	75	26.6	Comfort
28	4 October 2022	01.00	26	85	25.22	Comfort
		04.00	26	87	25.324	Comfort
		07.00	27	79	25.866	Comfort
		10.00	31	66	28.892	Comfort
		13.00	30	64	27.84	Comfort
		16.00	29	73	27.434	Comfort
		19.00	27	80	25.92	Comfort
		22.00	27	83	26.082	Comfort
29	5 October 2022	01.00	27	82	26.028	Comfort
		04.00	27	83	26.082	Comfort
		07.00	27	76	25.704	Comfort
		10.00	29	71	27.318	Comfort
		13.00	32	55	29.12	Discomfort
		16.00	30	62	27.72	Comfort
		19.00	25	92	24.6	Comfort
		22.00	25	90	24.5	Comfort
30	6 October 2022	01.00	26	92	25.584	Comfort
		04.00	25	92	24.6	Comfort
		07.00	26	86	25.272	Comfort
		10.00	30	66	27.96	Comfort
		13.00	33	56	30.096	Discomfort
		16.00	24	94	23.712	Comfort
		19.00	24	93	23.664	Comfort

No	Date	O'clock	Temperature (˚C)	Humidity (%)	THI	Criteria
		22.00	25	92	24.6	Comfort
31	7 October 2022	01.00	25	92	24.6	Comfort
		04.00	25	93	24.65	Comfort
		07.00	25	86	24.3	Comfort
		10.00	29	72	27.376	Comfort
		13.00	31	62	28.644	Comfort
		16.00	31	66	28.892	Comfort
		19.00	28	81	26.936	Comfort
		22.00	27	86	26.244	Comfort
32	8 October 2022	01.00	27	87	26.298	Comfort
		04.00	26	89	25.428	Comfort
		07.00	26	84	25.168	Comfort
		10.00	30	73	28.38	Comfort
		13.00	32	64	29.696	Discomfort
		16.00	30	62	27.72	Comfort
		19.00	25	91	24.55	Comfort
		22.00	24	87	23.376	Comfort
33	9 October 2022	01.00	24	87	23.376	Comfort
		04.00	24	89	23.472	Comfort
		07.00	25	85	24.25	Comfort
		10.00	29	72	27.376	Comfort
		13.00	31	69	29.078	Discomfort
		16.00	31	72	29.264	Discomfort
		19.00	24	85	23.28	Comfort
		22.00	25	90	24.5	Comfort

Table 2 shows that at 01.00,04.00, 07.00,19.00 22.00 it is comfortable, and at 10.00 and 16.00 some are comfortable and uncomfortable, and at 13.00 some are comfortable, uncomfortable and very uncomfortable. When it rains, 13.00 is comfortable.

If THI, T, and RH are time dependent (t), then Equation (1) becomes

$$THI(t) = 0.8T(t) + \frac{1}{500}(RH(t) \times T(t)) \quad (2)$$

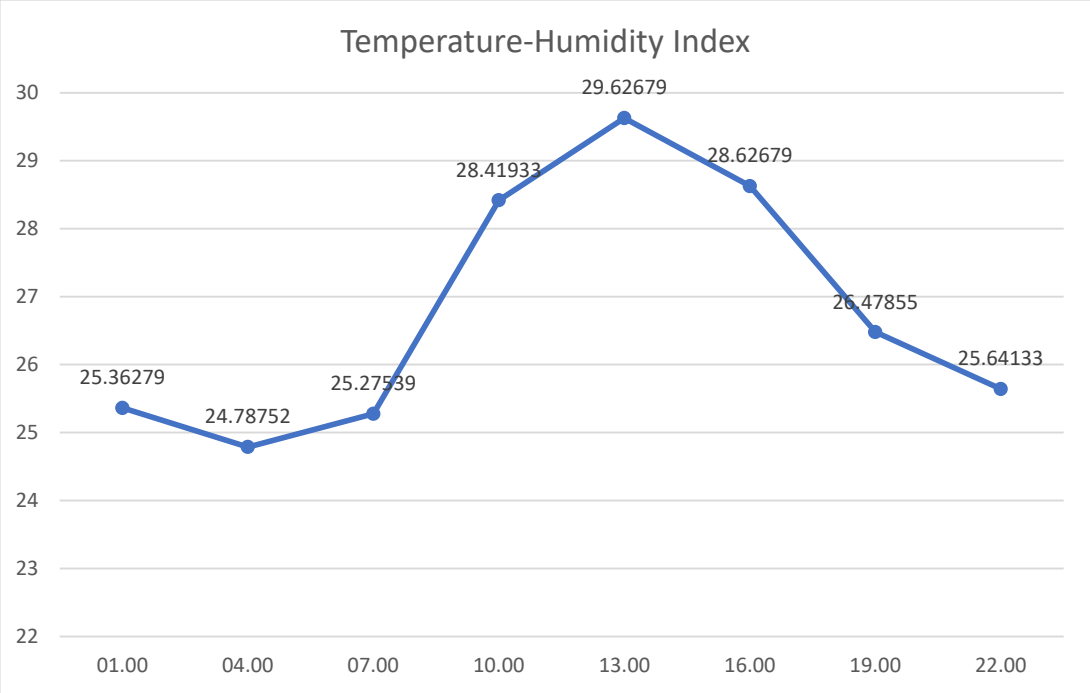
Jika Persamaan (2) diturunkan terhadap t, then we get

$$\frac{dTHI(t)}{dt} = 0.8\frac{T(t)}{dt} + \frac{1}{500}\left(\frac{dRH(t)}{dt} \times T(t)\right) + \frac{1}{500}\left(RH(t) \times \frac{T(t)}{dt}\right) \quad (3)$$

Equation (3) shows that changes in temperature and humidity will result in changes in comfort. Table 3 is the average THI. Table 3 shows the average other than 13.00 DIY the criteria is comfortable, while at 13.00 the criteria is not comfortable. Figure 1 shows the DIY daily average pattern. From Figure 2 at 13.00 it shows that the DIY criteria are not comfortable.

Table 3. Average THI

No	O'clock	THI
1	01.00	25.36278
2	04.00	24.78752
3	07.00	25.27539
4	10.00	28.41933
5	13.00	29.62679
6	16.00	28.62679
7	19.00	26.47855
8	22.00	25.64133



. **Figure 1. Pattern of Average Daily THI**

3. CONCLUSION

The Daerah Istimewa Yogyakarta is one of the provinces in Indonesia. At 01.00, 04.00, 07.00, 19.00 and 22.00 in DIY the comfort level is comfortable. This we can work optimally because the DIY area is convenient. These hours without air conditioning will be comfortable for school children to learn. The mathematical model formed by the level of comfort is influenced by changes in temperature and changes in humidity.

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