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Thermal Comfort Study of Young Chinese People in Hong Kong

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The purpose of this study is to investigate the thermal comfort of college-age Chinese subjects and obtain the optimum thermal conditions for buildings. 134 college-age Chinese subjects wearing 0.6 clo standard clothing were exposed under sedentary activity for 3 h to several different thermal conditions. The neutral temperature of young Hong Kong Chinese was found to be 24.9°C. This is not significantly different from previous studies with Danish and American subjects. Using the probit technique for analysing subjective responses of thermal sensation the neutral zone was found to be between 22.2 and 25.2°C.

INTRODUCTION

THE SUBJECT of thermal comfort has been studied over many years and in different parts of the world. Such studies aim to find acceptable indoor conditions for the design of air-conditioning and other thermal control systems in buildings.

There are two main streams of thermal comfort studies, namely, field surveys [1, 2] and controlled climatic chamber studies [3–6]. The most important climatic chamber study, which forms the basis for the setting-up of Fanger's Comfort Equation (FCE) [3] is the extensive experiment done by Nevins *et al.* [4] on 720 college-age Americans in 1966. Since the FCE is based upon college-age Americans, it may be doubtful whether it could be generally applied to other national–geographical locations and other age groups. It was mainly for this reason that Fanger performed his experiment on the Danes in 1970 and the result shows that the FCE can also be applied to elderly Danes as well as those of college age [3]. Since then, similar experiments have been performed in many areas of the world including, among others, countries in Asia such as Japan [6]. However, no such studies have ever been done in Hong Kong and no similar reports were noted from mainland China or Taiwan. It is therefore desirable to see whether the FCE can also be applied to the Chinese, in particular, Chinese living in the hot and humid southern coastal region of China.

The purpose of the present study was to investigate the preferred temperature and the comfort zone of college-age Hong Kong Chinese and the percentage of unacceptability for various thermal conditions. The differences of preferred temperatures between college-age Hong Kong Chinese, Europeans, and North Americans were also examined. The results can be used in energy-efficient air-conditioning design in Hong Kong and the surrounding areas.

EXPERIMENTAL METHOD

Subjects and clothing

One hundred and thirty-four Hong Kong Chinese college-age persons (84 males and 50 females) were used as subjects for this study. Only persons in good health were allowed to participate. All subjects were volunteers from students of the Hong Kong Polytechnic. The subjects were exposed to the thermal environments for three hours in groups of four to six persons. Each subject participated in only one test, so as to preserve naivety in the voting procedure. Anthropometric data for the subjects are listed in Table 1.

During the experiments, all subjects were clothed in cotton twill shirts and trousers, underwear, and socks. In order that the results of the present study can be compared with the results of previous studies [3–6], the current clothing ensembles closely resemble the KSU standard uniform. The clo-value of the uniform was estimated to be 0.6.

Experimental facilities

The experimental programme was carried out in the environmental chamber in the Department of Building Services Engineering of the Hong Kong Polytechnic. In the test chamber (4 × 2.6 × 2.1 m high), conditioned air is supplied from the ceiling and returned through the low side wall grille. Air temperature can be accurately controlled. However, relative humidity can be accurately controlled only for relative humidities greater than or equal to 40%. This is partly due to the provision of a humidifier only (there is no dehumidifier) and partly due to the latent load from persons sitting inside the chamber. There is also control of wall surface temperature. Mean radiant temperature and mean air velocity were monitored during the experimental sessions and were found

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Table 1. Anthropometric data for the subjects

Group	Sex	Number	Age (years)	Height (m)	Weight (kg)	Body surface area† (m^2)	Ponderal index ($kg^{1/3}\ m^{-1}$)
College-age subjects in Hong Kong Polytechnic	Female	50	20.28 ± 1.61*	1.60 ± 0.05	50.9 ± 6.1	1.50 ± 0.10	2.29 ± 0.08
	Male	84	20.62 ± 1.91	1.71 ± 0.06	60.4 ± 7.8	1.70 ± 0.12	2.25 ± 0.09
	Female + male	134	20.49 ± 1.81	1.67 ± 0.08	56.9 ± 8.6	1.63 ± 0.15	2.27 ± 0.09

* Standard deviation.
† DuBois area, $A = 0.202\ W^{0.424}\ h^{0.725}$.

to be constant throughout any experimental session. All parameters were monitored and recorded every half-an-hour.

Experimental conditions

In each experimental session the air temperature and the relative humidity were held constant by the control mechanism in the control chamber. The mean radiant temperature and the air velocity were monitored and found to be constant for any given setting of air temperature and relative humidity. Moreover, the mean air velocity was found to be about 0.1 m s^{-1} (*ie* still air) for all experiment sessions. The air temperature ranges from 21 to 28°C in steps of 1°C and the relative humidity varies from 40% to 80%. The selected combinations of conditions for experiments are shown in Table 2.

Each of the fifteen test conditions were maintained during two experiments in groups of 4–6 persons. The number of subjects for each condition is 8–10, with 3 or 4 females and 5 or 6 males. The three-hour test periods were conducted either in the morning (9–12 a.m.) or in the afternoon (2–5 p.m.) during the period from November 1988 to April 1989.

Experimental procedure

Table 3 shows the experimental plan. The procedure was similar to that applied in similar studies of thermal comfort [3–6] except that there was no provision of a pre-test room for the subjects to stay in for an additional thirty minutes before the experiments.

The subjects reported for the tests at the time scheduled, having been asked previously to have a normal night's sleep, and a normal meal about one hour before the experiment. They were then recorded for personal data including age, sex and height. After that they were weighed by a precision balance and then seated around a table. The subjects were asked to remain seated and

Table 2. Experimental conditions

I/(°C)	40% rh	50% rh	60% rh	70% rh	80% rh
21	*				
22	*	*			
23		*			
24		*	*	*	*
25		*	*		
26	*		*		
27				*	*
28				*	

Exposure time 3 h; clothing 0.6 clo; air velocity < 0.1 m s^{-1}; activity 1 met sedentary.
* Marked settings for experiments.

allowed to read, study, or perform equally quiet activities. Quiet conversation was permitted but the subjects were not allowed to exchange views concerning the thermal environment.

After half-an-hour, the subjects completed a thermal questionnaire that contained the scales shown in Fig. 1. Every half-an-hour thereafter, the questionnaire was repeated. Moreover, the subjects were weighed every hour in order to determine the evaporative heat loss during the experimental session.

After the final thermal questionnaire had been completed, a ballot (Fig. 2) was distributed to obtain information about the subject's ability to connect comfort with the temperature scale. This ballot, which did not concern the main purpose of the experiment, included a rating scale, developed by Rohles [7], consisting of a vertical listing in random order of 24 temperatures ranging from 10 to 33°C in one degree increments. Beside each temperature was a blank in which the subject recorded his rating. The subjects were instructed to place a "C" beside the temperatures they considered to be comfortable, when seated and dressed as in the present experiment. If the temperature was considered cooler or warmer than comfortable they were asked to place a minus or plus in the rating column respectively.

ANALYSIS AND RESULTS

Regression analysis on thermal sensation vote

To ensure steady-state conditions, the mean values of the last three votes only were used for the final analysis. A regression analysis was performed to determine the relation between mean vote and ambient temperature. As the influence of humidity has been well established, all experimental combinations of ambient temperature and humidity were first converted to that ambient temperature by Fanger's Comfort Equation at 50% rh and 0.1 m s^{-1} air velocity, which would be felt equally warm. This is defined as the modified temperature [6].

In Table 4, the calculated regression equations for the estimated mean thermal sensation vote are given as a function of modified temperature for the different groups of subjects, *ie* Hong Kong Chinese, Danes and Americans, and for both sexes. The modified temperature corresponding to the neutral mean vote ($Y = 4$) is defined as the neutral temperature. The neutral temperature of college-age Hong Kong Chinese was found to be 24.9°C. This suggests that young Hong Kong Chinese prefer a temperature lower than the Americans by 0.7°C and of the Danes by 0.8°C, but these differences are not significant. However, it may be worth noting that Hum-

Table 3. Experimental plan

Time (mins)	Personal record	Questionnaire (ref. Fig. 1)	Measurement of environmental variables	Measurement of weight of subjects	Ballot (ref. Fig. 2)
0	*		*	*	
30		*	*		
60		*	*	*	
90		*	*		
120		*	*	*	
150		*	*		
180		*	*	*	*

* Marked items to be done during specified periods

phrey [1] suggested that preferred conditions may be slightly warmer in cold climates and slightly cooler in warm ones. The correlation coefficient for Hong Kong Chinese subjects between modified temperature and the mean of thermal sensation votes was surprisingly high at 0.988 ($n = 134$). The corresponding t-value is 73.493 and is far greater than that required by the t-value at 5% level of significance, which is 1.980 only. In other words, thermal sensation had a very good relation to Fanger's thermal load L [3], which is defined as the difference between the internal heat production and the heat loss to the actual environment for a man hypothetically kept at the comfort values of the mean skin temperature and the sweat secretion appropriate to the actual activity level. The regression lines and the corresponding points for Hong Kong Chinese subjects are plotted in Fig. 3, together with those lines for Danes and Americans for comparison.

In Fig. 4 the regression lines of mean thermal sensation vote against modified temperature for Hong Kong Chinese college-age females and males are shown.

It is seen that there is no significant difference in neutral temperature between Hong Kong Chinese and American college-age subjects. A significant difference was found between the sexes for both Hong Kong Chinese and Americans, but not for Danish subjects. This also suggests that females prefer a higher temperature than males for both Hong Kong Chinese (by 1°C) and American (0.82°C), while the opposite was the case for the Danes (the difference being at 0.57°C).

QUESTIONNAIRE ON ENVIRONMENT (VOTES)

I. RECORD ON SUBJECTS/VOTING TIME:

Name: ____________________

Class: ____________

Date: ____________

Time: ____________ (am/pm)

II. THERMAL SENSATION:

How do you feel this thermal environment?

(Please choose and tick one of the following:)

1. Cold
2. Cool
3. Slightly cool
4. Neutral
5. Slightly warm
6. Warm
7. Hot

III. COMFORT SENSATION

Do you feel this environment comfortable or not?

(Please choose and tick one of the following:)

0. Comfortable

-1. Slightly uncomfortable

-2. Uncomfortable

-3. Very uncomfortable

IV. ACCEPTABILITY

Can you accept this thermal environment (Yes/No)?

____

Fig. 1. Questionnaire with thermal sensation vote, comfort sensation vote, and vote for acceptability. This questionnaire is to be filled in every half hour.

SURVEY ON THE SUBJECT'S ASSESSMENT ON PREFERRED TEMPERATURE

In the following temperature list, put "+", "-" or "c" beside the temperatures (deg C) if you consider them to be hotter than comfortable, colder than comfortable, or comfortable respectively:

1. 22 deg C (___)
2. 23 deg C (___)
3. 30 deg C (___)
4. 32 deg C (___)
5. 10 deg C (___)
6. 21 deg C (___)
7. 13 deg C (___)
8. 12 deg C (___)
9. 29 deg C (___)
10. 18 deg C (___)
11. 26 deg C (___)
12. 33 deg C (___)
13. 25 deg C (___)
14. 28 deg C (___)
15. 14 deg C (___)
16. 15 deg C (___)
17. 31 deg C (___)
18. 27 deg C (___)
19. 16 deg C (___)
20. 20 deg C (___)
21. 24 deg C (___)
22. 11 deg C (___)
23. 17 deg C (___)
24. 19 deg C (___)

Fig. 2. Questionnaire concerning the subjective estimate of comfort temperatures.

Table 4. Regression equations for different groups of subjects

Group	Number	Regression equation	Neutral temperature (°C)	Correlation coefficient (r)	t-value of r	Significant of r at 5% level
College-age Hong Kong Chinese						
Females + males	134	$Y = -5.218 + 0.3666\ T$	24.9	0.988	73.49	yes
Females	50	$Y = -3.972 + 0.3267\ T$	24.4	0.980	34.12	yes
Males	84	$Y = -5.166 + 0.3615\ T$	25.4	0.987	55.61	yes
College-age Danish [3]						
Females + males	128	$Y = -3.836 + 0.3048\ T$	25.7	0.716	11.51	yes
Females	64	$Y = -5.963 + 0.3907\ T$	25.5	0.803	10.61	yes
Males	64	$Y = -1.709 + 0.2190\ T$	26.1	0.615	6.14	yes
College-age Americans [4]						
Females + males	720	$Y = -4.625 + 0.3376\ T$	25.6	0.796	35.24	yes
Females	360	$Y = -5.678 + 0.3735\ T$	25.9	0.834	28.60	yes
Males	360	$Y = -3.574 + 0.3019\ T$	25.1	0.783	23.82	yes

Y = Estimated population mean vote.
T = Ambient temperature (rh = 50%).

Probit analysis of thermal sensation vote

On the other hand, since the thermal sensation voting scale is the seven-point scale, it only shows the step-wise relation between the thermal sensation and the environmental variables. It may be doubtful therefore whether the assumption that equal temperature changes on the thermal sensation scale produce the same thermal sensation changes is always valid, as assumed in the linear regression model.

A probit analysis [8] is therefore carried out to find the transition temperatures from slightly cool to neutral and from neutral to slightly warm. The result (Fig. 5) shows that the neutral zone is from 22.2 to 25.2°C which bounds the neutral temperature of 24.9°C, which lies more to the upper bound of the zone. A preferred temperature derived from the transition temperatures, such as the mean can be defined and is found to be 23.7°C, which is 1.2°C below that found from the linear regression analysis. However, since confidence limits for this value from such definition are not readily established (because the

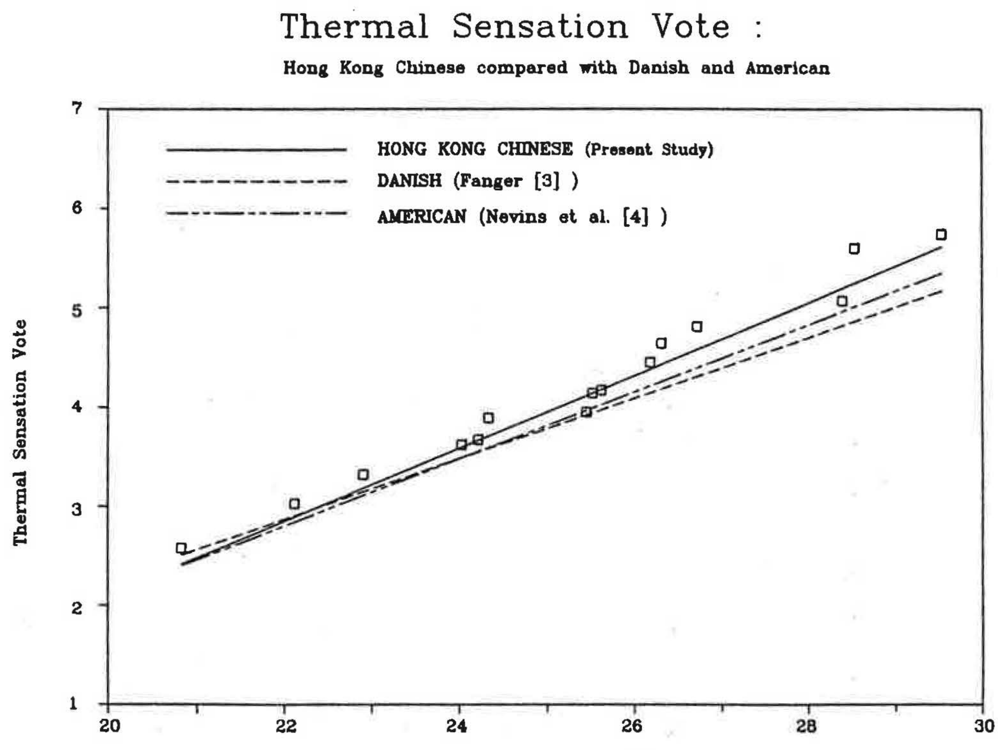


Fig. 3. Mean thermal sensation vote *vs* modified temperature for Hong Kong Chinese college-age subjects. Each point represents the mean of 8–10 subjects. The solid curve is the regression line for individual votes (n = 134). For comparison were shown the dotted curve for Danish college-age subjects (Fanger [3]) and the phantom curve for American college-age subjects (Nevins *et al.* [4]).

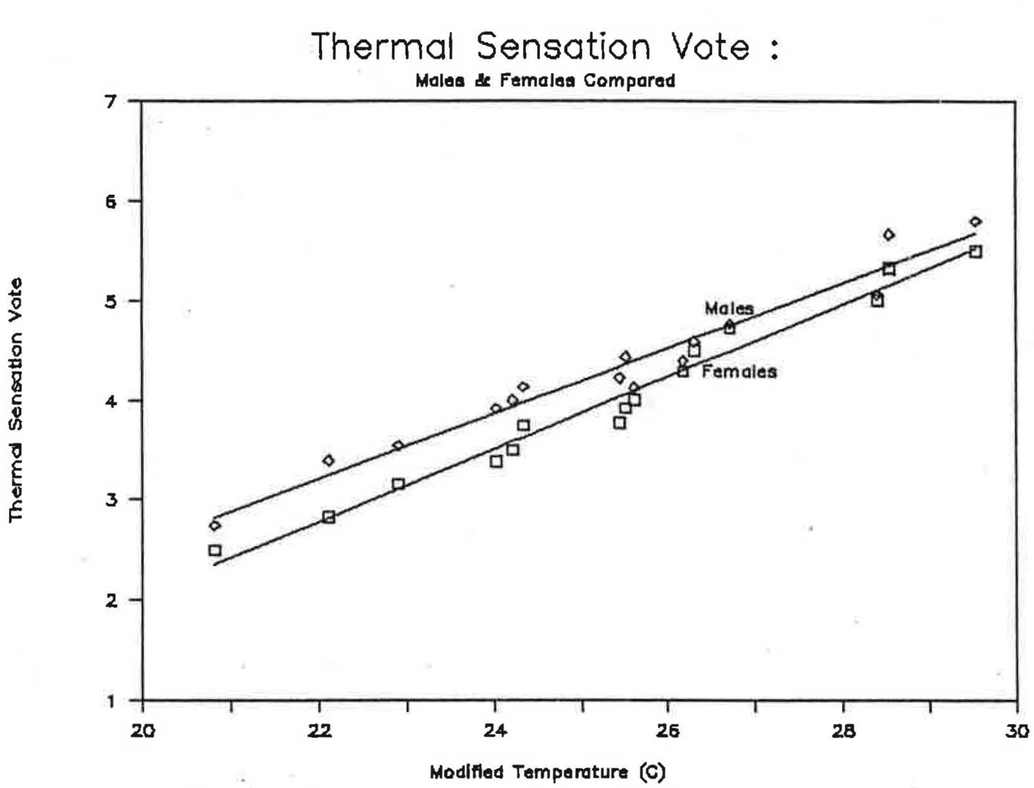


Fig. 4. Mean thermal sensation curve *vs* modified temperature for Hong Kong Chinese college-age females and males. Each point represents the mean of 3 or 4 subjects (for females) and 5 or 6 subjects (for males).

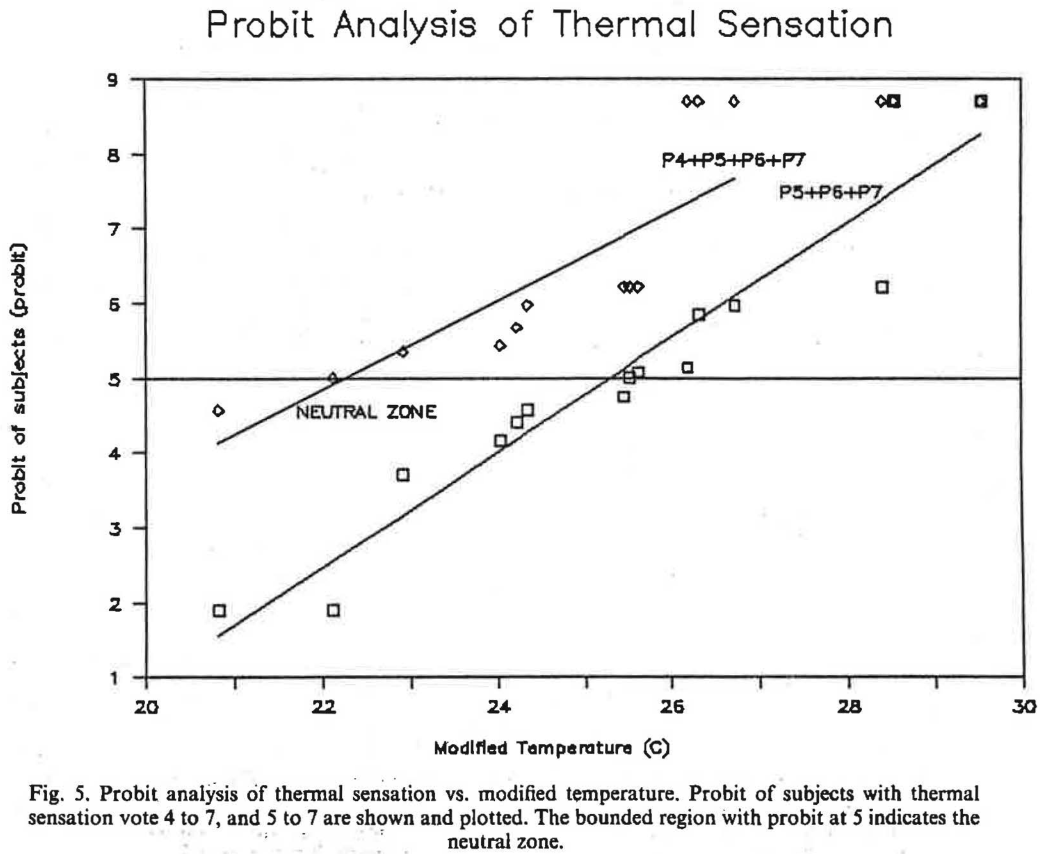


Fig. 5. Probit analysis of thermal sensation vs. modified temperature. Probit of subjects with thermal sensation vote 4 to 7, and 5 to 7 are shown and plotted. The bounded region with probit at 5 indicates the neutral zone.

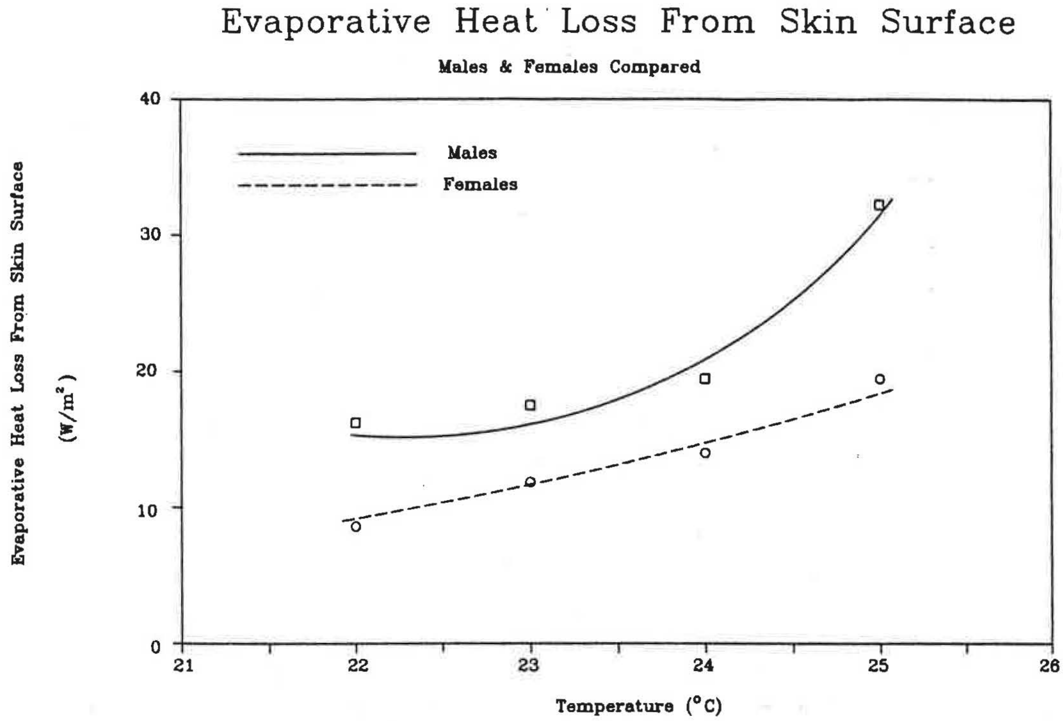


Fig. 6. Evaporative heat loss from skin surface at 50% relative humidity. Each point represents the mean of 3 or 4 subjects (females) or 5 or 6 subjects (males). From the total evaporative heat loss, the latent respiration was subtracted to find the evaporative heat loss from skin surface.

two samples from which the transition temperatures are derived are not independent), it can hardly be concluded that the two results are significantly different based on that comparison. What can be concluded is that the neutral temperature lies within the neutral zone as found by probit analysis. The present result compares very closely with the probit analysis of ASHRAE's seven point scale done by Dedear and Auliciems [2] in subtropical Brisbane in Australia which gives a neutral temperature of 23.8°C in air-conditioned buildings.

Evaporative heat loss

Figure 6 shows a comparison between evaporative heat loss from the skin surface of males and females against ambient temperature at only 50% relative humidity. The reason for choosing 50% rh only is due to the availability of more data at 50% rh settings. Total evaporative heat loss from the human body was calculated from the weight loss within the three hours period. From the total evaporative heat loss, latent respiration heat loss was subtracted to find the evaporative heat loss from skin surface. It was found from the figure that males sweat more than the females at the comfort zone of 22–25°C, the difference being 5 W m^{-2} at 23°C and 13 W m^{-2} at 25°C.

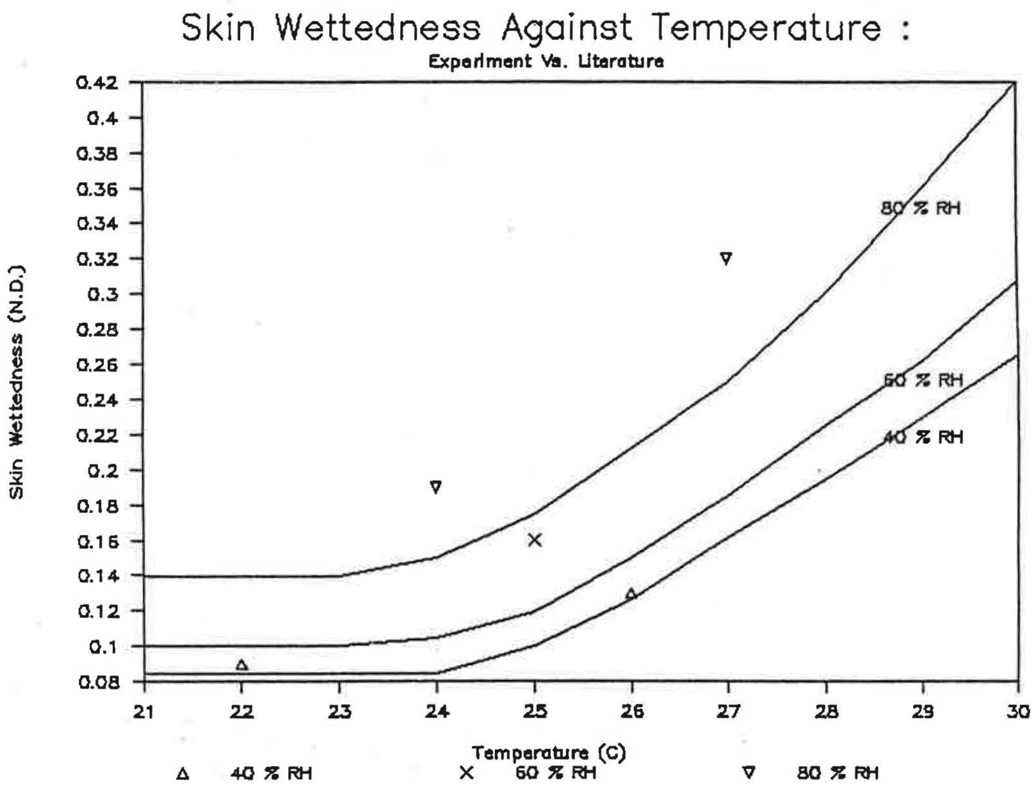
Skin wettedness

Figure 7 shows skin wettedness, calculated from evaporative loss, against temperature at various relative humidities. The skin wettedness was calculated by first using equation (9a) of ref. [3] for the evaporative heat loss from the skin surface and then equation (14) of ref. [9] to obtain the skin wettedness. Since skin temperatures were not measured in the present experiments, a regression equation between mean skin temperature and modified temperature was used for analysis (equation (28) of ref. [9]). For comparison, five curves were obtained from literature. It was found that Hong Kong Chinese sweat more than the Americans at relative humidities higher than 40%, especially at high ambient temperatures, the difference ranges from 0.01 at 50%, 22°C to 0.07 at 80%, 27°C. However, at 40% relative humidity, their skin wettedness is more or less the same as shown in Fig. 7. As quoted in [6], Osada postulated that people who live in hot climates sweat less until a certain temperature is reached, but above that sweat more than those who live in a cold climate when exposed to the same conditions. The present study does not indicate the temperature "threshold" for which the postulate holds, but however reflects the same after that "threshold". Moreover, the effect is more significant at higher relative humidities.

Comfort sensation votes

In the present study, a comfort sensation vote (shown in Fig. 1) was obtained simultaneously with the thermal sensation vote and acceptability. The last three votes were used for the final analysis. Since the comfort sensation vote may not have the same width of category, probit analysis [8] was used.

Figure 8 shows the probit of subjects who answered "uncomfortable" (namely, "very uncomfortable", "uncomfortable", or "slightly uncomfortable") vs modified temperature. A probit regression line was obtained between the corresponding probits and the modified temperature. It indicates a close relation between probit of "uncomfortable" and modified temperature. In other



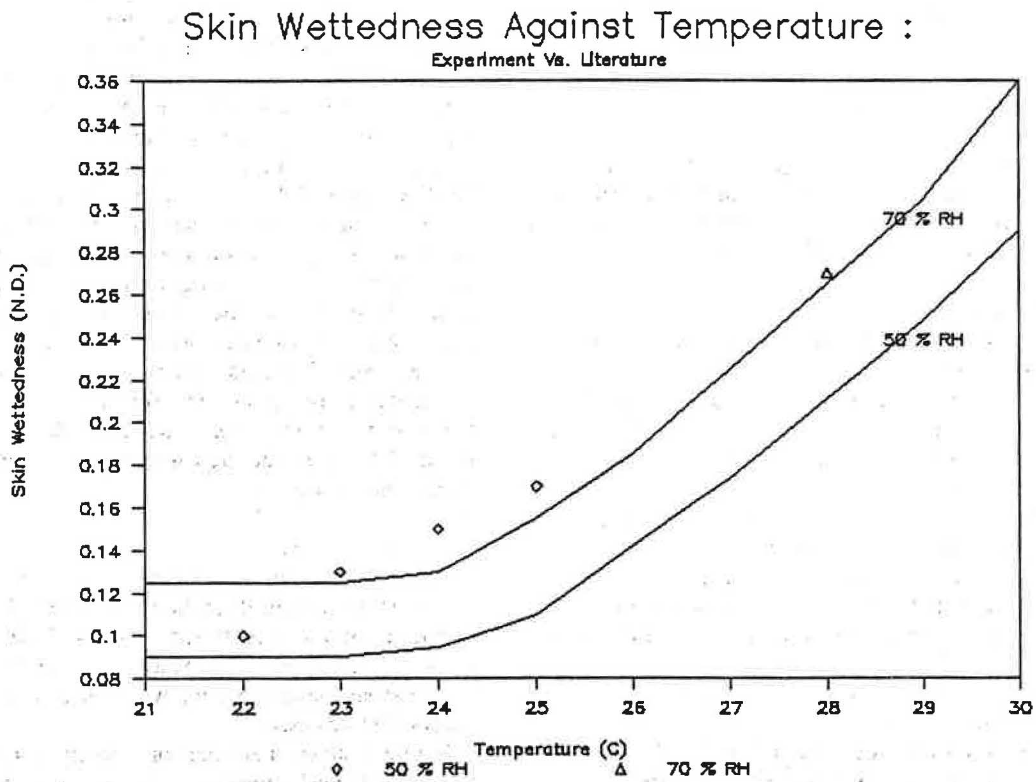


Fig. 7. Skin wettedness *vs* temperature at various humidity levels. Each point is calculated from the mean evaporative heat loss of 8–10 subjects. For comparison, five curves of skin wettedness at 40%, 50%, 60%, 70% and 80% rh were calculated by equations in literature.

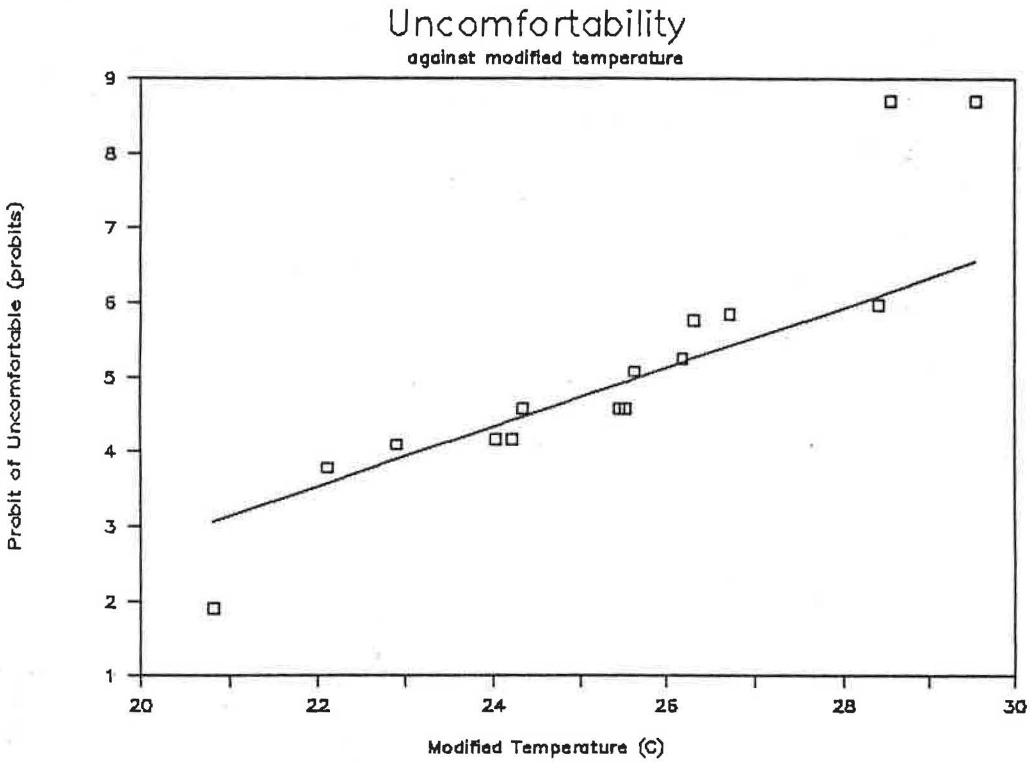


Fig. 8. Probit analysis of the subjective responses concerning uncomfortable *vs* modified temperature. Each point was calculated from the last three votes of 8–10 subjects.

; the percentage of "uncomfortable" is a function : modified temperature, the relation being linear :en the corresponding probits and the temperature. degree of dependency being at a slope of 0.673 probit degree rise in modified temperature.

'igure 9 shows the percentage of subjects who ,wered "uncomfortable" (namely, "very uncomfort- le", "uncomfortable", or "slightly uncomfortable") skin wettedness predicted by literature. Once again, close relation between the probit of "uncomfortable" .nd predicted skin wettedness was observed. The skin wettedness associated with 50% "uncomfortable" (5 probit) was 0.14.

Acceptability

In Fig. 10 a regression line based on a probit analysis shows the percentage of subjects indicating unacceptability as a function of the modified temperature. The mean values of the last three votes were used for the analysis. Once again, it shows that the probit of unacceptable is a linear function of the modified temperature. However, a comparison between the present study of the relation between the percentage of unacceptable and the PPD model by Fanger *vs* Predicted Mean Vote (PMV) shows a significant discrepancy. It may mainly be attributed to the present equipment limitation to provide an adequate fresh air supply to the subjects sitting inside the chamber which has a positive effect when the PMV is greater than -0.04 (-0.04 is at about middle of the region between slightly cool to neutral), and a negative effect when the PMV is lower than -0.04. In other words, insufficient air supply will help to decrease the number of persons dissatisfied in environments colder than that when the PMV is at -0.04 but will increase it when the environment is hotter than this. Furthermore, from Fig. 11, the effect of decreasing the number of persons dissatisfied is by 11.4% at PMV $= -0.9$ and up to a high value of 54% at PMV $= -1.84$. On the other hand, it will increase the percentage by only about 15% at PMV $= 0$ to 23% at PMV $= 5$. A shift in the minimum of percentage of dissatisfied from PMV $= 0$ to PMV $= -0.04$ is due to the neutral temperature of the present study being lower than that upon which the PPD model is based.

It therefore suggests that insufficient air supply increases the number of persons dissatisfied in hot environments but will help to reduce it in cold environments, the effects being progressively prominent towards the extreme ends of the PMV axis, especially in the cold extreme.

Comfort estimates on the temperature scale

In the present study, a ballot (Fig. 2) was distributed during the end of each experimental session to see whether the subjects could relate comfort to temperature scale. For each subject the mean of the highest and lowest temperature estimated as comfortable was calculated. This value is taken to be the temperature which the person concerned would estimate as optimal for him under the given conditions. Moreover, the differences between the highest and lowest temperature was also calculated, this representing the range on the temperature scale within which the subject estimated that he would be comfortable. The result is tabulated and shown in Table

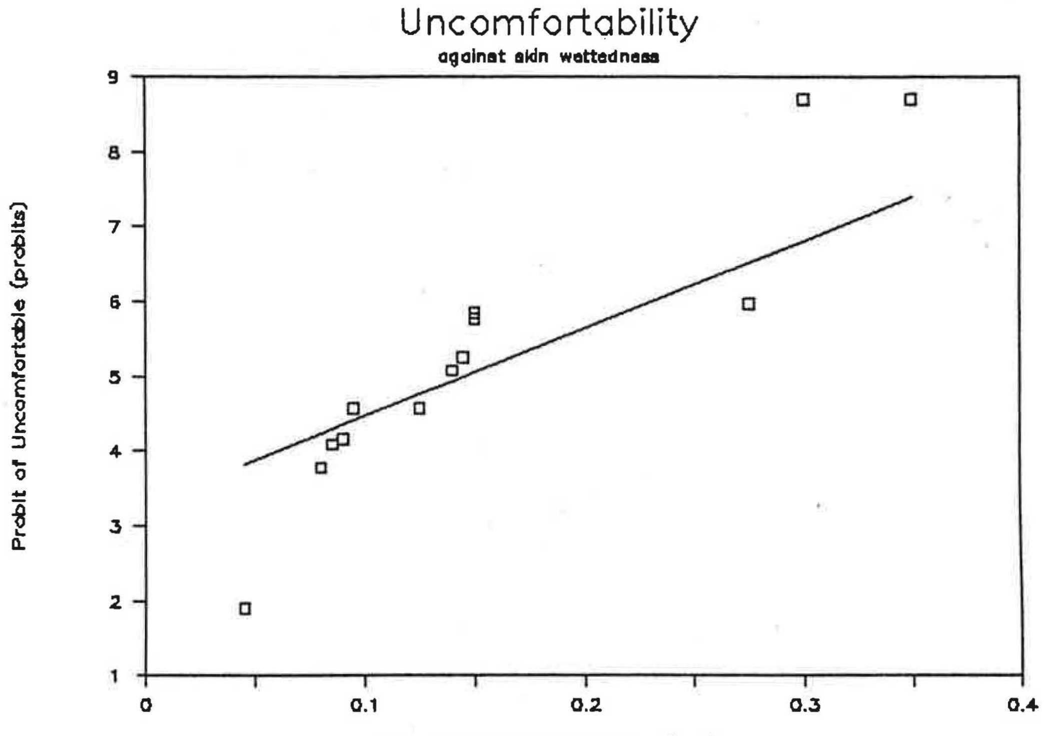


Fig. 9. Probit analysis of the subjective responses concerning uncomfortable *vs* skin wettedness calculated by equations in literature. Each point was calculated from the last three votes of 8–10 persons.

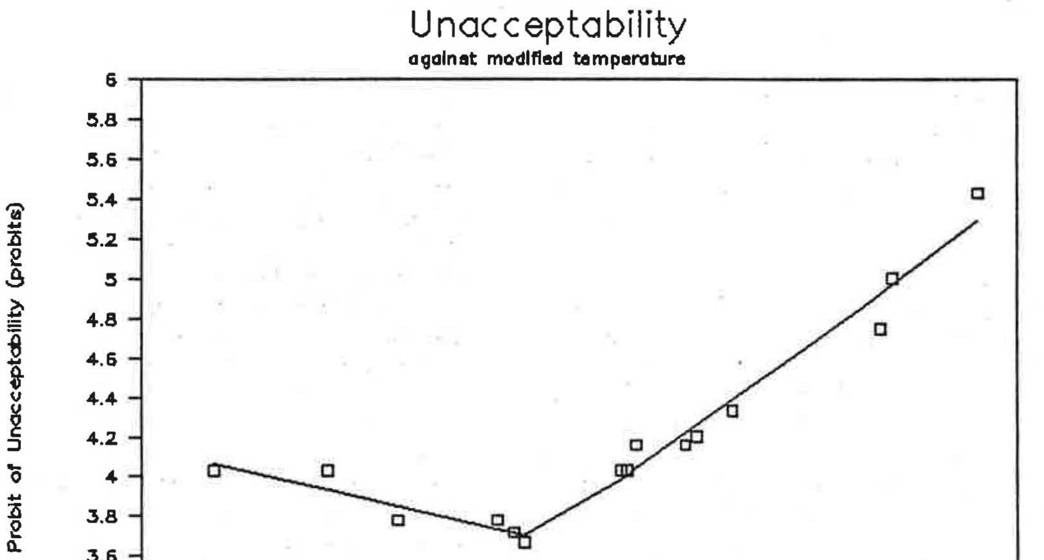
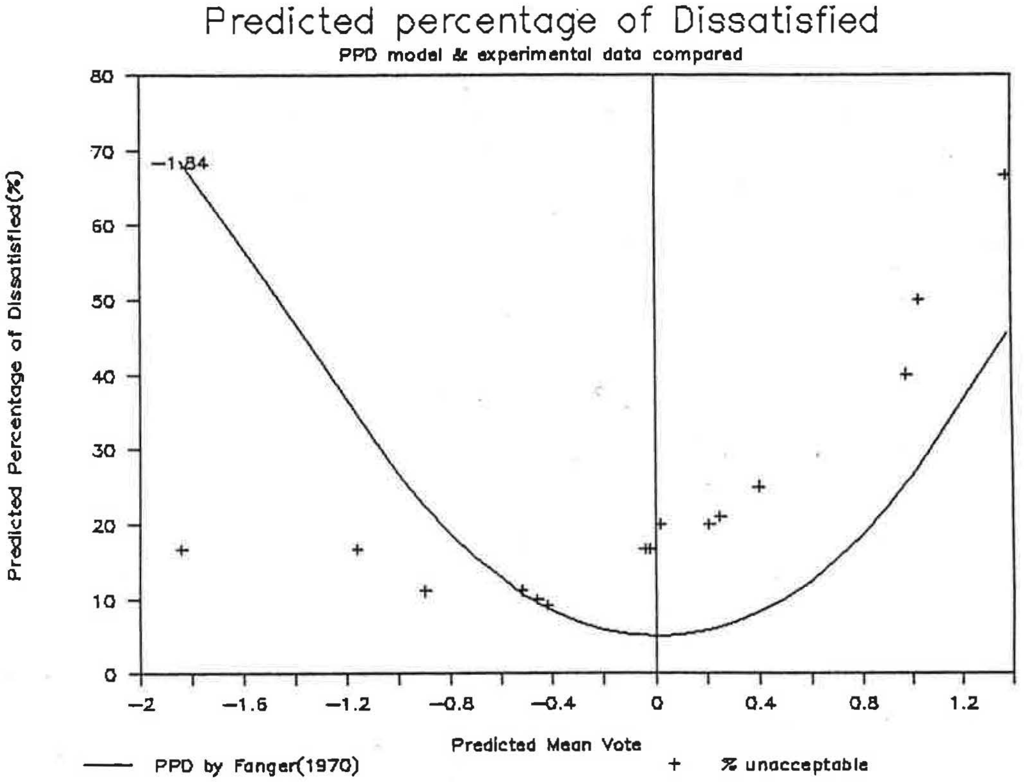


Fig. 10. Probit analysis of the subjective responses concerning unacceptability. Each point was calculated from the last three votes of 8–10 subjects.



'ig. 11. Predicted percentage of unacceptable for Hong Kong Chinese as a function of predicted mean 'ote (PMV). The predicted percentage of dissatisfied (PPD) for American and Danish subjects [3] is shown for comparison.

ıich it can be seen that the estimated comfort re ranges from 21 to 22°C, which are lower predicted from thermal sensation using linear ı analysis by 3 to 4°C. This shows that the ɔns apparently have little experience in relating to the temperature scale.

DISCUSSION

ıal–geographical difference in thermal response

order to check the applicability of the thermal com- equation to Hong Kong Chinese and to have results are comparable to the studies by Nevins and Fanger Americans and Danes, the set-up of the present experi- nt has been made as similar as possible to theirs. ɔwever, due to equipment and time limitations, it is ıpossible to study all the environmental variables and ıe effects of each combination of these studied on the ıermal sensation. Nevertheless, present study on the egression lines and neutral temperatures of the Hong Kong Chinese and the Danes and Americans shows no significant differences and the thermal sensation vote has a strong linear dependence on the temperature from linear regression analysis.

Sex and body build differences

Although the number of male and female subjects was not the same in the present study, regression lines and neutral temperatures between the two groups of subjects can still be compared and the results show that the difference in the neutral temperature is significant at the 5% level. Males always feel warmer than females and are less sensitive to temperature changes. This conforms to the findings by McIntyre [10] on analysing KSU data that the slopes of thermal sensation for females were bigger than that for males. Furthermore, since the metabolic rate of females is less than that of males [11], females may feel cooler than males. The effect is, however, somewhat offset at higher temperature regions where the skin wettedness due to evaporative heat loss for females is

Table 5. Values on the temperature scale estimated as optimal by the subjects

Group	Sex	Estimated optimal temperature (°C)	Estimated comfort range (°C)
College-age Hong Kong Chinese	Females+males	21.53±2.21	5.47±3.12
	Females	21.25±1.97	6.30±2.69
	Males	21.70±2.32	4.98±3.25

Table 6. Comparison between different neutral temperatures for thin and obese subjects

Group	Ponderal Index ($kg^{1/3}\,m^{-1}$)	Neutral temperature (°C)	Difference between neutral temperature (°C)	Mean of neutral temperature t_m (°C)	Difference between mean votes at t_m dY	Estimated variance of dY $s^2\,dY$	t-Value of $s^2\,dY$	Significant of 5% level?
Fattest half	2.33±0.07	25.55	0.08	25.49	−0.02	0.6340	−0.1384	no
Thinnest half	2.21±0.05	25.47						

Fattest half are those that have Ponderal Index > 2.2716.
Thinnest half are those that have Ponderal Index < 2.2716.
Number of both groups = 67.

lower than that of males which may be due to the lower metabolic rate of females.

Although it is a common belief that a fatter person will always find an environment hotter than that felt by a thinner person, the present study, in Table 6 which gives a statistical analysis between the fattest half and the thinnest half, shows no such difference. In fact it shows that the thinnest half prefer a temperature that is 0.1°C below that of the fattest half, but the difference is not significant at 5% level. The basis on which "fat" and "thin" is based is the Ponderal Index, which is the third root of the weight divided by the height and the figure of distinction between the two groups is a Ponderal Index of 2.2716.

Comfort sensation and acceptability

Probit of persons voting uncomfortable shows a good linear function with the modified temperature as well as the skin wettedness. It may therefore be concluded that the percentage of persons feeling uncomfortable is a cumulative normally distributed function of both stimuli from the theory of probit analysis. In other words, the relations between the percentage of uncomfortable and Fanger's thermal load and the skin wettedness are cumulative normally distributed curves.

Although the observed percentage of unacceptability, which is based upon a separate subjective judgement, shows a dramatic departure from the PPD model curves, it can be attributed to the inadequate fresh air supply and the present findings of the neutral temperature being lower than that used in the derivation of the PPD curve. As a by-product of the present study, it seems to suggest that an insufficient air supply, although it increases the level of dissatisfaction in the warm zones, it will help to reduce that number in the cold zones.

CONCLUSION

The neutral temperature of college-age Hong Kong Chinese clothed at 0.6 clo is 24.9°C, which is 0.7°C lower than the Americans and 0.8°C lower than the Danes, but the differences were not significant. A probit analysis shows that the neutral zone for thermal comfort, which is the region between slightly cool to slightly warm, is bounded by 22.2 to 25.2°C, which agrees quite well with the simple linear regression analysis.

The neutral temperature of Hong Kong Chinese females is 25.4°C and is higher than that of males by 1°C (which is 24.4°C). A significant difference is found therefore at the 5% level. Moreover the females are more sensitive to temperature changes.

At 40% relative humidity, Hong Kong Chinese sweat as much as the Americans; whereas they sweat more than the Americans at relative humidities higher than that, especially at higher temperatures. The difference is up to 0.07 at 27°C, 80% RH.

Males sweat more than females at a modified temperature range between 20 and 30°C, the amount being from 5 W m^{-2} at 23°C to 13 W m^{-2} at 25°C.

No significant difference was found in the neutral temperatures between persons of different build.

An insufficient air supply increases the number of people feeling uncomfortable in the warm zone but suggests that it will decrease the number by an amount up to 50% at the cold zone.

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