Seasonal Changes of Salivary Immunoglobulin A under
the Influences of Two Types of Clothing

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There are some papers concerning factors such as season, psychological stress, physical stress and some social habits which influence the immune system. For example, Abo et al. (1978; 1981) showed that there are circadian and seasonal variations in the appearance of B lymphocytes bearing surface immunoglobulin in the peripheral blood in man. Carandente et al. (1988) pointed out that B-lymphocyte counts in the circulation exhibited circannual variations, being lower in winter than in summer. Landmann et al. (1984) found that psychological and physical stress increased the numbers of circulating monocytes, B cells and NK cells and the numbers of leucocyte subpopulation. Hedfors et al. (1983) and Mori (1992) pointed out that physical stress could alter the functioning of immune system. However, little attention has been paid to the effects of clothing on immune system. Changes in clothing during certain seasons are one of the several factors which are associated with the occurrence of respiratory infectious disease (Tromp, 1964). Park and Tokura (1994) studied the physiological effect of two types of clothing (i.e. half-sleeve shirts and knee-length trousers and long-sleeve shirts and full-length trousers) on salivary IgA concentration. They found that salivary IgA was significantly higher in half-sleeve shirts and knee-length trousers than in long-sleeve shirts and full-length trousers. It has been shown that subjects wearing skirts for three months from September to November and from April to June had better cold tolerance (Li et al., 1994) and heat tolerance (Li and Tokura, 1995) respectively, than those wearing full-length trousers. However, it remains to be established whether an improvement of cold and heat tolerance by wearing knee-length skirts is accompanied by an increased immune activity. Thus, although what is worn seems to influence the immune system, there is a far from systematic understanding concerning the relationship between immune activity and clothing. Therefore, the present experiment aimed to establish the changes of salivary IgA during the process of seasonal acclimatization in the three months from September to November under the influences of the two types of clothing.

Materials and Methods

Ten female adults volunteered as subjects. They were randomly divided into two groups. Five subjects in one group (skirt group) wore the knee-length skirts during the daytime for three months from September to November, while the other five subjects (trouser group) dressed in full-length trousers for the identical period. During the period from September to November, the outdoor temperatures fell gradually. The mean maximum and minimum outdoor temperature during the period were 30.0°C and 19.4°C in September, 24.0°C and 13.4°C in October and 17.8°C and 7.3°C in November, respectively. The air conditioning system was not used during that period in the University. There did not exist any consistent differences between the two groups in the clothing worn over the upper half of the body (as checked at least once a week). The physical characteristic of the subjects were as follows: in the skirt and trouser group, the age (mean ± SEM) was 21.1 ± 1.2 and 22.5 ± 0.8 yrs, height 158.1 ± 1.4 and 160.0 ± 2.2 cm, and body mass 49.8 ± 1.7 and 48.6 ± 2.2 kg, respectively. There were no significant differences for these values between the two groups. Experimental procedures were well understood by the subjects. All subjects gave their consent to the experiments.

In order to analyze the saliva, we asked each subject to collect ca. 3 ml saliva for the first seven days of September, October and November immediately after waking up in the morning. The saliva sample was placed in a refrigerator immediately after collection. The saliva samples were analyzed for IgA in a clinical laboratory using the Latex agglutination immune method (Hirata et al., 1987).

Data were analyzed using Student's t-test to compare seasonal changes of saliva for the same group (paired) and differences between the two groups for the same season (unpaired).
Results

Figure 1 shows seasonal changes in salivary IgA from September through October to November in the skirt and trouser groups. As seen in the figure, the value in IgA increased gradually with the advance of season in the skirt group, and there was a significant difference between September and November (p<0.05, paired). On the contrary, there did not exist any significant differences in IgA values among September, October and November in the trouser group. As the interindividul differences in IgA concentration were great, their seasonal changes between the two groups were also compared relatively. When the values in September were assigned to 100%, they were 114.3 ± 5.7% in trouser group and 141.2 ± 10.3% in skirt group in November, which tended to be different (p<0.10, unpaired). This suggests that IgA concentration of skirt group tend to be higher than that of trouser group with the advance of the season.

Discussion

What physiological mechanisms could account for the finding that the salivary IgA (of the subjects wearing the knee-length skirts) increased with the advance of the season from September to November ?

Sorkin et al. (1981) found that a reduced noradrenaline content in the spleen of the sympathetomized animals could increase the immune response. Landmann et al. (1984) suggested an involvement of the sympathetic nervous system in the immunoregulatory responses to stress. Thus, the sympathetic nervous system and immune activity are strongly linked. It has been shown that core temperature dropped to a greater extent during night time in the subjects with half-sleeved shirts and knee-length trousers than in those with long-sleeved shirts and full-length trousers (Jeong and Tokura, 1989; Hashimoto and Tokura, 1991; Lee and Tokura, 1993). These authors discussed these findings in terms of the different activity in the sympathetic nervous system according to the clothing worn. In other words, if the extremities are directly exposed to the surrounding air in the subjects wearing half-sleeved shirts and knee-length trousers, the sympathetic nervous system would need to be more active in order to maintain the core temperature. Therefore, this might result in its greater relaxation during the night time and, therefore, in a quicker fall and lower level of core temperature. A similar argument has been advanced by Park and Tokura (1994) to explain their finding that salivary IgA was significantly higher during the night time in subjects with half-sleeved shirts and half-length trousers than in those with long-sleeved shirts and full-length trousers.

If this were the case in our present experiment, the repeated exposure of the lower extremities to a progressively colder surrounding air in the skirt group might have led to a more active sympathetic nervous system during the daytime than in the trouser group. This might have resulted due to its greater relaxation during the night time, and therefore, the elevation of IgA in the skirt group with the advance of the seasons.

Therefore, it is concluded that the type of clothes that we wear in our daily life is of significance for salivary IgA concentration.

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References


9-14
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