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# CHANGES IN IMMUNE FUNCTION, SERUM THYROID HORMONES, PLASMA CATECHOLAMINES AND MOOD OF THE 21ST DOME-A EXPEDITIONERS AND 20TH CHINESE EXPEDITIONERS IN ANTARCTICA

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**Introduction:** Long-term exposure to the extreme and isolated Antarctic environment is considered to be both physiologically and psychologically stressful. In order to understand the relationships between these two forms of stress and identify potential mechanisms, we examined relationships between and changes in immune and neuroendocrine function and mood in Chinese Antarctic expeditioners in Zhongshan station (16 winter people), Great Wall station (12 winter people) and Dome-A (8 summer people) during Dec. 2003 to Mar. 2005.

**Methods:** Blood samples were collected in 4 different periods: departure, winter, summer and return. Lymphocytes of expeditioners were collected before their departure and after return to carry out Lymphocyte Transformation Test (LTT). Under the conditions of stress an immunosuppressive of protein (ISPS) was generated in T lymphocyte, which acted as an immune suppressor. The lymphocyte proliferation with spleen of mice was suppressed by the ISPS in serums of the stressed expeditioners. Serum samples were collected at 4 different periods to test their biologic activity of ISPS enable to evaluate stress. To test the levels of serum IL-1β/IL-2αwas assayed at each period by ELISA. Serum thyroid hormones including total thyroxine ($TT_4$) and free $T_4$ ($FT_4$), total triodothyronine ($TT_3$) and free$T_3$ ($FT_3$), and thyroid stimulating hormone (TSH) were tested by Chemoluminescence Immunoassay (CLIA). Plasma catecholamines, including norepinephrine (NE), epinephrine (E) and dopamine (DA), were examined by High Performance Liquid Chromatography with electrochemical detection (HPLC-ECD). Expeditioners also completed the Profile of Mood States (POMS) questionnaire once a month during their Antarctic residence. Comparisons of outcome measures between periods and across months of observations or by station were conducted with the use of paired samples t–tests and the one-way ANOVA, respectively.

**Results: 1.** Immune Function: No significant change in Lymphocyte Transformation Rate (LTR) of LTT was observed in Great Wall expeditioners after 13 months of residence in Antarctica ($p>0.05$). Before departure , the LTR of Zhongshan expeditioners was lower than that of Great Wall Station expeditioners; however, the LTR of Zhongshan expeditioners increased significantly after stay 15 months in Antarctica ($p <0.001$). The SI and the LTR of ISPS for winter expeditions declined with increased duration in Antarctica. The SI and the LTR of ISSP for Zhongshan expeditioners were significant lower than those of Great Wall expeditioners ($p<0.01$). The SI and the LTR of ISSP for Zhongshan expeditioners were the lowest in winter but increased significantly after their return ($p<0.01$). The changes of the LTR and the biological activity of ISPS were related to the mood of the expeditioners. The level of IL-1βof Dome-A expeditioners increased significantly upon return to Zhongshan Station from Dome-A ($p<0.01$). No significant changes were observed in levels of IL-1β for both of Great Wall and Zhongshan Station. The level of IL-2α decreased significantly in Great Wall expeditioners after a stay of 1 year in Antarctica while the same happened to Zhongshan expeditioners ($p<0.01$). No significant changes in level of IL-2αwas observed in Dome-A expeditioners.

**2.** Serum Thyroid Hormone: There was a significant increase in the level of $TT_3$ ($p<0.05$) with no significant changes in the levels of $TT_4$, $FT_3$, $FT_4$ and TSH in Great Wall Station expeditioners after 13 months in Antarctica. For Zhongshan expeditioners, there was a significant increase in the level of $TT_3$ ($p<0.01$). Levels of $FT_4$ decreased significantly in

Antarctica ($p<0.001$)but recovered upon return to China. The levels of TSH increased significantly in Antarctica and remained so upon return ($p<0.01$). No significant changes of levels of $TT_4$, $FT_3$ were observed. The level of TSH increased significantly among Dome-A expeditioners during their stay in Antarctica and remained at high levels until their return to China ($p<0.01$). It recovered to baseline levels 3 months after their return to China.

**3.** Plasma catecholamine: For Great Wall expeditioners, the level of NE decreased significantly in winter ($p<0.05$). No significant change in the levels of E and DA were observed. For Zhongshan expeditioners, the level of NE decreased significantly in Antarctica ($p<0.05$), reaching its lowest level in winter ($p<0.001$) but increasing in summer and recovering upon return to China at levels higher than departure ($p<0.05$). The levels of DA decreased significantly during the austral summer in Antarctica ($p<0.05$)and recovered to baseline levels upon return to China. The level of DA of Dome-A expeditioners increased significantly during their stay in Antarctica ($p<0.05$).

**4.** Mood: Expeditioners at Great Wall Station reported significantly higher levels of anger during their first two months in Antarctica ($p<0.05$), follwed by a slow decline to baseline levels upon return to China. Significant increases in fatigue ($p= 0.002$), depression ($p<0.001$), anger ($p=0.001$), tension/anxiety ($p<0.001$), and confusion ($p=0.004$), all reaching a peak during the month of July, were reported among Zhongshan Station expeditioners. Dome A expeditioners reported significantly more confusion ($p=0.034$) during their stay in Antarctica compared to baseline.

**Conclusion:** Prolonged isolation and confinement in a polar environment had significant effects on immunity and neuroendocrine function of Chinese expeditioners. Furthermore, there were different changes between Chinese expeditioners who stayed in Antarctica during different periods, at different stations, and with different assignments.