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BIOMARKERS FOR DETECTING THE STRESS FROM CONFINED ENVIRONMENT: A  
SYSTEMATIC REVIEW

**Abstract**

**Background and aim:**

Several simulations of staying in International Space Station (ISS) and Mars expeditions have been conducted. Many studies surveyed changes in biomarker levels for detecting the stress of confined environment. However, there is no gold standard to assess the confinement stress. The aim of the present study is to identify biomarkers that can assess the confinement stress via a systematic review.

**Method:**

Two different databases, PubMed and Embase, were searched to determine what kind of biomarkers are useful for detecting the stress from confined environment. Search terms were selected by using a PECO approach, which stands for Population, Environment, Control and Outcome. Populations were astronauts, subjects of confinement study, polar explorers, etc. In terms of outcomes, we included the studies which surveyed blood, salivary, and urinary samples as biomarkers for detecting the stress. Only articles written in English were selected. The risk of bias in the included articles was assessed using RoBANS for non-RCT studies.

**Results:**

In total, 2,035 articles from the two databases were searched. Next, 410 duplicates were omitted. Titles and abstracts of 1,625 articles were assessed, and then the full texts of 223 articles were collected. From these, 115 articles were excluded, and finally 108 articles were included to assess their quality. Subjects were astronauts, volunteers of confinement studies, submariners, and polar explorers. The detected immunological changes due to confined environment stress were different depending on studies. On the

other hand, most studies showed an increase of cortisol and catecholamine secretion. The changes in electrolytes such as sodium, potassium, calcium, and chloride might be affected by microgravity rather than the confined environment.

Conclusions:

The present review showed the possible availability of cortisol and catecholamine for detecting any confined environment stress, but until now there has been no consensus on applicable methodology. In order to develop a standardised method for confinement stress assessment, further studies are needed.