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AN OBSERVATIONAL CASE STUDY ON THE RESPONSE OF INSULIN-DEPENDENT DIABETES MELLITUS TO ALTERED GRAVITY CONDITIONS IN A HUMAN TEST SUBJECT

Abstract

In March 2021, after an 11-year hiatus, the European Space Agency (ESA) opened applications for astronaut candidates. For the first time ever, it was announced that individuals with physical disabilities were eligible to apply, paving the way for increased access to space. At present, only physical disabilities qualify for selection and not chronic health conditions such as diabetes. However, with the prospect of space tourism and long-duration space missions, understanding the effects of altered gravity conditions on chronic health conditions is becoming increasingly more important, particularly if an astronaut were to develop such a condition mid-flight. To date, research on this has been sparse, particularly in human test subjects.

This paper presents the results of an experiment designed to test the effect of altered gravity conditions (mainly microgravity) on insulin-dependent diabetes mellitus (IDDM) in a human test subject. Diagnosed with IDDM on 19 November 2020, the human test subject was placed onboard an Airbus A310 Zero G parabolic flight on 17 February 2023 to create altered gravity conditions. The subject's most recent glycated haemoglobin (HbA1C) reading prior to the flight was 47 mmol/mol (which is classed as having excellent control) with no problems concerning hypoglycaemia awareness and no discernible complications due to his condition. The participant was subjected to 16 parabolas in total, each of which would induce forces of either 0.38G, 0.16G or 0.01G for a period of 22 seconds and 1.8G for a period of 20 seconds during the parabola pull-up and pull-down. Measurements were taken at various points in the flight with a Libre 2 flash glucose monitor (FGM) which was worn by the test subject. On analysing the results post-flight, it can be determined that there was a drop in the participant's blood glucose (BG) levels for the 0.38G and 0.16G parabolas, whereas his BG levels began to rise when introduced to 0.01G. Despite this, these observed spikes and drops in BG levels during the flight were insignificant and indiscernible over a 24-hour period.

Regardless, it is important to note that there were several limitations of this study, most notably that IDDM is not universal amongst patients. As such, the results from this experiment may not necessarily be reproduceable or widely used in other scenarios. However, they do provide a point of reference on the possible reaction of BG levels in IDDM patients during altered gravity conditions, providing impetus for more ambitious studies in the future.