

NAD(H) in the plasma and cerebrospinal fluid of healthy humans

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Purpose:

Nicotinamide adenine dinucleotide (NAD⁺) is a ubiquitous molecule that participates in a number of biological processes as a coenzyme and redox couple and as a donor of ADP-ribose units. While the physiologic and pathologic importance of these reactions in both the periphery and central nervous system (CNS) has become increasingly apparent it is not yet known whether a relationship exists between peripheral and central stores of NAD⁺. The aim of this current study was to assess the relationship between plasma and cerebrospinal fluid (CSF) levels of NAD(H) in healthy participants across a wide age range.

Methods:

Blood and CSF samples were collected from consenting patients scheduled for either a caesarean section or total hip/knee replacement at the Sydney Adventist Hospital. Blood and CSF samples were collected no longer than 30 minutes apart and stored within 1 hour at -196°C until analysis. Total NAD(H) concentrations in plasma and CSF samples were measured spectrophotometrically using a thiazolyl blue microcycling assay.

Results:

The mean total NAD(H) in healthy participant CSF was 81.3 µg/ml (n=50, 95% CI: 74.4 to 88.1) compared to plasma 314.1 µg/ml (n=28, 95% CI: 293.5 to 334.6). The concentration of total NAD(H) in plasma positively correlated with the concentration of total NAD(H) in CSF ($r^2=0.188$, $p=0.02$, $n=29$). As previously demonstrated by our lab in both blood and tissue samples, CSF total NAD(H) was significantly lower in the older population (>50 years) compared to those in the younger population, less than 50 years (n=50, $p=0.045$).

Conclusion:

This is the first known study to determine the concentration of total NAD(H) in the CSF of healthy participants and provides evidence that the levels of total NAD(H) in the CNS reflect, to a significant degree, those in the periphery and decrease with age.