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HAART used to treat HIV/AIDS has serious side-effects, including metabolic complications from mitochondrial toxicities that can limit effectiveness. It is important therefore to limit patients' exposures to these drugs by personalizing dose or time on therapy, and by switching ARTs as adverse effects are detected. Such management would be aided greatly by application of simple tests for mitochondrial toxicity that could be detected prior to onset of overt clinical symptoms because clinical symptoms, once present, are persistent and only partially reversible with shifts in therapy. As early detection will require frequent testing, it is important that testing does not require invasive tissue sampling and that the tests are relatively inexpensive. Currently there are no simple methods to monitor mitochondrial function/dysfunction. To meet this need we have developed a set of simple lateral-flow immunoassays (dipsticks) for key mitochondrial proteins of the OXPHOS system, which is responsible for production of >95% of cellular energy. These tests are accurate, specific, sensitive and reproducible, with CVs less than 10%. We previously reported that these tests can detect mitochondrial OXPHOS dysfunction in both peripheral fat and PBMCs of patients on HAART who have a clinical diagnosis of lipodystrophy (Marusich et al., 2006, 13th Conference on Retroviruses and Opportunistic Infections; Abstract #667b). Here we describe results using human cell culture model systems in which the tests are used to monitor and characterize progressive declines in OXPHOS function resulting from *in vitro* exposure to an NRTI (ddC) known to cause adverse clinical effects associated with mitochondrial dysfunction. We also show for the first time that these dipstick tests can be used to accurately measure levels of mitochondrial OXPHOS enzymes in tissue samples obtained by non-invasive means (cheek swabs) and minimally-invasive means (fingerprick whole blood samples). OXPHOS dipstick analysis of these samples is extremely reliable and simple, providing a platform with great potential for routine, repetitive clinical application, potentially suitable for use at point of care, even in resource-poor settings. In summary, the tests are useful research tools to study the metabolic complications of HAART and may serve as theranostic aids to help guide HAART.