Past evidence of altered human brain glutamate levels in patients with schizophrenia suggest that abnormalities in N-methyl-D-aspartate (NMDA) glutamate receptors contribute to the pathophysiology of schizophrenia. Traditional antipsychotic medication can alleviate some of the symptoms of schizophrenia (so-called positive symptoms), but the most debilitating symptoms (so-called negative and cognitive symptoms) do not respond well. Oral supplementation with D-serine may alleviate negative and cognitive symptoms believed to be induced by glutamatergic abnormalities by acting as a co-modulator of the NMDA glutamate receptor at the glycine site. Detection of endogenous levels of human brain serine has been impossible using standard proton Magnetic Resonance Spectroscopy (1H-MRS) due to its low concentration compared to other metabolites. Previous studies report a reliable assessment of brain levels of serine by applying advanced 1H-MRS methods conducted on non-clinical 4.0 and 7.0 Tesla (T) scanners. This work presents the first attempt of implementing a novel 1H-MRS protocol, called DANTE-PRESS, at the more common clinical field strength of 3.0T, in order to quantify endogenous levels of brain serine. The goal of the project is to investigate implementing a novel 1H-MRS method on a clinical scanner of 3.0T and further perform a test-retest reliability study by comparing the results obtained at 7.0T. Our first task was to achieve 1H-MRS data from a series of phantoms containing various metabolite concentrations. In vitro demonstration repeated measurements were obtained from in vivo [0.732] mM and double in vivo [1.464] mM serine concentrations at baseline, and one week later at 3T. Future work will include examining the developed technique in-vitro by acquiring phantom data at 7T and in-vivo by obtaining test-retest reliability data from the brain of healthy subjects at 3T and 7T. The proposed study will demonstrate the reliability and reproducibility of the measurements of serine obtained in vitro and in healthy subjects. The method can be used to detect possible abnormalities in serine levels in neuropsychiatric disorders or monitor the administered D-serine supplements more efficiently.