K42 Serum Albumin Binds Synthetic Cannabinoids and Model Compounds and Drugs

Oluseyi A. Vanderpuye, PhD, Albany State University, Forensic Science, Albany, GA 31705; Alexius K. Lampkin, Headland, AL 36345; Johnathan Jones, BS, Albany State University, Forensic Science, Albany, GA 31705*

Learning Overview: After attending this presentation, attendees will learn: (1) how agarose gel electrophoresis and spectroscopy can be applied to detect binding of certain synthetic cannabinoids, prescription drugs, and compounds with serum albumin; and (2) that interactions of synthetic cannabinoids and drugs with serum albumin are a consideration for the pharmacokinetics of synthetic cannabinoids and other compounds.[1]

Impact on the Forensic Science Community: This presentation will impact the forensic science community by showing how serum proteins affect drug bioavailability and methods of characterizing drug-serum protein interactions. Additionally, the community will become more aware of the use of spectroscopic methods for characterizing interactions of different compounds with albumin. Interpretation of toxicological data may be influenced by agents that affect the blood concentration of free drugs and compounds and their lifetimes.[2,3] Albumin has demonstrated relevance for these parameters for many compounds of toxicological interest; therefore, consideration of its effects on pharmacokinetics of synthetic cannabinoids warrants more investigation.

Serum albumin is known to bind a diversity of non-polar organic compounds and drugs.[1-4] It was hypothesized that human and bovine serum albumin would bind to synthetic cannabinoids such as Bay 59-3074 and JWH-015, which are non-polar molecules with ring structures that are practically insoluble in aqueous solution.

For this study, binding to albumin was tested for the synthetic cannabinoids and as controls, model compounds such as the dye Nile Red, eosin, bromophenol blue, coumarin, the drugs tobramycin, colchicine, and a brand name mixture of brimonidine tartrate and dexamethasone to further advance knowledge of compounds that bind serum albumin.

Agarose gel electrophoresis was one method used for assessing binding of the synthetic cannabinoids and other compounds to albumin. Ultraviolet/Visible (UV-Vis) and fluorescence spectroscopy were other applicable methods.[3,4] The compounds used can be visualized by their color or by their UV-induced fluorescence. In the absence of BSA, non-polar synthetic cannabinoids and model compounds would not be expected to migrate in agarose gels or be visible after electrophoresis. If any of these compounds bind to albumin, then their complexes would migrate in agarose gel electrophoresis bound to the albumin and be visible by their intrinsic color or fluorescence under UV-light.

It was found that in agarose gel electrophoresis in the presence but not in the absence of albumin, fluorescent bands at the position of albumin were observed for mixtures with Bay 59-3074 and JWH-015 and for mixtures of albumin with Nile Red, eosin, coumarin, the drugs tobramycin, colchicine and mixture of brimonidine tartrate and dexamethasone. In the absence of these compounds, albumin was not fluorescent or colored. It was also observed that in the presence of albumin, compounds such as eosin, bromophenol blue and Nile Red changed color. In the presence of albumin, under UV-light, Bay 59-3074, JWH-015 and Nile Red became more fluorescent. This suggested that interaction of these and other compounds would be detectable by changes in the UV-Vis and fluorescence spectra.

In conclusion, it was observed for the first time that the synthetic cannabinoids Bay 59-3074 and JWH-015 bind serum albumin. This could affect their bioavailability and allow these drugs to attain higher concentrations in blood than permitted by their non-polar character and allow them to circulate longer. The use of agarose gel electrophoresis to detect albumin binding to synthetic cannabinoids and other compounds has not been previously reported and is applicable to the study of albumin interaction with compounds of pharmacological significance that are fluorescent or colored.

Reference(s):

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Cannabinoids, Albumin, Electrophoresis