

VIRGINIA DEPARTMENT OF FORENSIC SCIENCE

EVALUATION OF AUTOSOMAL/Y QUANTITATION RESULTS OBTAINED WITH POWERQUANT® IN COMBINATION WITH THE END POWERPLEX® FUSION RESULTS TO DETERMINE A RATIO CUTOFF VALUE AT WHICH A SAMPLE MAY BE AMPLIFIED USING ONLY A Y-STR AMPLIFICATION KIT

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PURPOSE

The Virginia Department of Forensic Science (the Laboratory) currently utilizes a PowerQuant® male quantitation value of N/A to discontinue testing for samples for which only a male typing result is of interest (i.e., the perpetrator is known to be male). Any samples for which the male quantitation value is greater than N/A are currently amplified with the PowerPlex® Fusion amplification kit. The results of this analysis, along with quantitation data obtained using PowerQuant®, are then evaluated to determine whether or not a sample should be referred for Y-STR testing. The Autosomal/Male quantitation ratio (Auto/Y quantitation ratio) can be useful in predicting whether an excess of female DNA in a sample will prevent the detection of a lesser amount of male DNA using an autosomal DNA amplification kit. This study is designed to evaluate and identify a cutoff value for the Auto/Y quantitation ratio obtained using PowerQuant® at which amplification with PowerPlex® Fusion will likely not yield a useful male typing result. The samples for which the Auto/Y quantitation ratio meets or exceeds the cutoff may be processed using only the current Y-STR amplification kit or discontinued after the quantification step.

MATERIALS AND METHODS

Ninety-two (92) PowerPlex® Fusion casework samples were investigated for this study. The sample set included data from all four regional Virginia Department of Forensic Science laboratories. The samples identified for this study were intimate or nearly intimate samples on which a female's DNA could be expected and the DNA of interest was from a male. The vast majority of the samples chosen are female body samples, although some are clothing/underpants samples. The associated PowerQuant® and PowerPlex® Fusion results were then evaluated for each sample. The data from the samples chosen were compiled in an Excel spreadsheet which included the autosomal quantitation value, the Y quantitation value, the Auto/Y quantitation ratio, the PowerPlex® Fusion result, and an assessment as to whether or not each sample was or should/could have been referred for Y-STR testing.

RESULTS

Of the 92 samples investigated, thirty (30) had an Auto/Y quantitation ratio above 15 and gave no usable male typing result with PowerPlex® Fusion. Forty (40) samples investigated had an Auto/Y quantitation ratio below 8, and generally all of these gave a useful male result with PowerPlex® Fusion. Samples with an Auto/Y quantitation ratio range of approximately 8-15, gave varying results.

CONCLUSIONS

All samples with an Auto/Y quantitation ratio of approximately 8 or less which gave no useful male autosomal typing result were low level samples with autosomal quantitation results below the required 0.10 ng/uL to meet the Laboratory's target of 0.5 ng/5uL for amplification. Therefore, the data still suggest that a sample with a ratio of 8 or less should continue through amplification with PowerPlex® Fusion and will likely yield useful male typing results if the overall amplification target concentration is met. A specific cutoff for obtaining useable male typing results with PowerPlex® Fusion between Auto/Y quantitation ratios of above 8 and below 15 was impossible to identify. As could be expected, however, the number of samples for which Y-STR referral would be recommended generally increases as the ratio approaches 15. Based upon the data seen in this evaluation, it would be difficult to predict the usefulness of the PowerPlex® Fusion results for a sample within this range of 8 to 15. Although it is likely that multiple samples within this range will be referred for Y-STR testing, it appears to be likely that a similar number in this group will give useful male typing results with PowerPlex® Fusion. Because PowerPlex® Fusion results are more discriminating than Y-STR testing results, samples within this range should be amplified with PowerPlex® Fusion first and then referred for Y-STR testing, if necessary. It is evident from this data, however, that any sample with an Auto/Y quantitation ratio at or higher than 15 is not expected to give a useful male typing result when amplified with PowerPlex® Fusion. Therefore, this study supports bypassing the amplification of these specific types of samples with PowerPlex® Fusion when the Auto/Y quantitation ratio meets or exceeds 15.

In assessing the data for these 92 samples, it is important to keep in mind that this evaluation applies only to a small subset of samples tested in the Laboratory. Specifically, samples were chosen to include intimate or nearly intimate samples on which a female's DNA could be expected and the DNA of interest was from a male. Cases in which body samples were collected from a male were not included and samples on which the female DNA could not be expected to be present were not included. It is also important to keep in mind that each sample investigated for this study was evaluated as if it were the only sample in a case. Therefore, the determination that a sample should have been referred for Y-STR testing was made solely based upon the quantitation values and final typing results with PowerPlex® Fusion. Not taken into account was whether or not the sample in question was the non-sperm fraction from a sample for which a useable PowerPlex® Fusion result was obtained from the sperm fraction or whether or not other samples in the case gave a useable PowerPlex® Fusion result which would therefore have

obviated the need for Y-STR referral. It is recommended that, when applying this cutoff, this type of case specific information is taken into account, so that unnecessary Y-STR testing is not conducted and samples for which developing the female DNA profile is desired can be amplified with the PowerPlex® Fusion kit, regardless of the Auto/Y quantitation ratio.

Based upon this study, it is recommended that an Auto/Y quantitation ratio cutoff of 15 be applied to casework. The data support that samples with a ratio of 15 or higher will likely not result in a useable male typing result when amplified with PowerPlex® Fusion. Applying a cutoff of 15 (i.e., bypassing amplification with PowerPlex® Fusion for any sample with a ratio of 15 or higher), allows for the capture of as many samples for which a useful male typing result may be obtained with PowerPlex® Fusion as possible, while reducing the number of unnecessary amplifications with PowerPlex® Fusion. The determination as to whether or not these samples with an Auto/Y quantitation ratio of 15 or higher are typed using the current Y-STR kit or testing simply discontinued should be based upon other workflow considerations and case scenario.

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