PGM ACTIVITY OF SALIVA AND ITS FORENSIC SIGNFICANCE

Graham B. Divall
Metropolitan Police Forensic Science Laboratory, 109 Lambeth Road,
London SE1 7LP, England

INTRODUCTION

One of the problems encountered in the analysis of dried stains is interpretation of grouping results obtained from mixtures of body fluids whether they be blood and saliva, semen and blood or semen and vaginal secretions. With this problem in mind, one of the questions we have studied is the effect of saliva on the phosphoglucomutase (PGM_1) typing of blood.

MATERIALS AND METHODS

All whole blood and saliva samples were collected in plain glass bottles from donors of known PGM_1 phenotype.

Samples were analysed for PGM avtivity by non-equilibrium focusing in ultra-thin polyacrylamide gels as previously described. (1)

RESULTS AND DISCUSSION

Whole Saliva and Saliva Stains:

Out of 402 saliva samples tested, weak PGM activity was detected in only 51 or 13% of them. Furthermore, the activity was never of sufficient strength to ascertain the PGM phenotype of the donor. PGM activity was not detected in any of the stains made from the saliva samples.

Blood/Saliva Mixtures:

From the results described above it appeared that saliva would have very little effect on the PGM typing of a bloodstain. To test this prediction, lysed blood samples were mixed with whole saliva and the mixture analysed for PGM activity. In some instances the PGM bands appeared

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to be stronger than the control blood samples but the most noticeable effect was that in some mixtures, extra bands of PGM activity were clearly visible (Fig. 1).

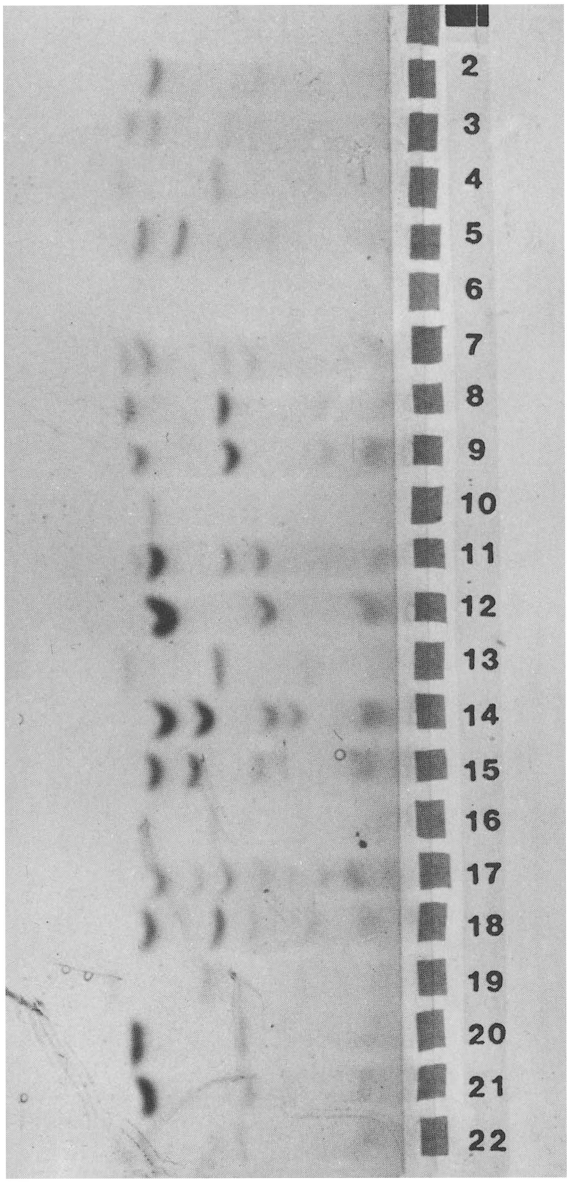

Fig. 1. PGM typing of blood / saliva mixtures

Sample no. 8 for example, consists of a PGM (1+) blood mixed with saliva from a PGM (2+) donor. Both the b+ and a+ isozymes can be clearly seen.

Sample no. 11 consists of PGM (1+) blood mixed with saliva from a PGM (2+1-) donor. A strong a+ isozyme can be seen with weaker bands in the b+ and a- positions.

Sample no. 17 consists of a PGM (2+1+) blood mixed with saliva from a PGM (2-1+) donor. The b+, a+ and b- isozymes are all visible.

One hundred and twenty-six blood/saliva mixtures were examined in this way and the extra PGM activity was observed in 90 (71%) of these samples. It was also clear from the results that the extra activity was derived from the saliva since in all instances it corresponded with PGM phenotype of the donor of the saliva. Since the saliva samples on their own contained little or no PGM activity it appeared that the blood contained a factor or factors which have the ability to activate or enhance the PGM activity of saliva.

These observations have two important implications when considering the analysis of body fluid stains. First, the phenomenon could be a source of mistyping in the PGM system. For example, if the blood from a victim of type PGM(1+) became mixed with saliva from an assailant of type PGM(2+), typing of the stain could give a PGM(2+1+) result and thus lead to an incorrect conclusion about the source of the blood. Secondly, characterization and purification of the enhancing factor may provide a means of typing saliva stains in the PGM system. With this possibility in mind a number of experiments were performed in order to characterize the PGM enhancing factor.

Properties of the PGM Enhancing Factor

1. The enhancing ability of blood is a property of the red cell and not the serum.

2. The enhancing property is not unique to human blood. For example, red cell lystaes from goat, sheep and rabbit blood all have the ability to enhance the PGM activity of human saliva.
3. The factor appears to have a molecular weight of greater than approximately 1400. This was demonstrated by dialysing red cell lysates for 24 hours to remove any low molecular weight substances. The dialysed lysates were found to retain their PGM enhancing ability.
4. Red cell lysates retained their enhancing activity after being heated to 80^{o}c for 30 minutes.
5. Incubation of red cell lysates with trichloroacetic acid precipitates total protein and also removes the enhancing factor or factors.

Further attempts to identify and isolate this factor have been unsuccessful. Its nature and mechanism of action therefore remain speculative.

CONCLUSIONS

1. Red blood cells from a range of animal species contain a factor or factors which have the ability to enhance the PGM activity of human saliva.
2. The enhancing phenomenon could be a source of PGM mistyping when analysing blood/saliva stain mixtures.
3. The factor is non-dialysable and is relatively heat stable.
4. Further characterization and purification of the enhancing factor may provide a means of typing saliva stains in the PGM system.

REFERENCES

(1) Divall G.B. and Ismail M. (1983) Forens.Sci. Int. 22, 253-263