Differentiation of *Taenia saginata* and *Taenia solium* by enzyme electrophoresis

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Summary

Forty-four *Taenia saginata* and seven *T. solium* specimens were collected in Nigeria. Extracts of these worms and of their metacestodes were compared by enzyme electrophoresis. The mobility of glucose phosphate isomerase was consistently faster with *T. saginata* than with *T. solium*. Extracts of the strobilate and cysticercous forms of the same species gave identical results. It was thus possible to distinguish clearly between material of either species.

Introduction

*T. solium* is the more important of the two taeniid worms found in man, because of the danger of human cysticercosis and, according to Verster (1967), it is possibly more common than is usually supposed. Inaccurate identification is one of the probable reasons for underestimating its prevalence. Although *T. solium* and *T. saginata* can be distinguished by various morphological characteristics of the scolex and the mature proglottides, it is difficult to differentiate the gravid proglottides usually found in the faeces. The number of branches of the uterus, which was formerly the characteristic used to distinguish gravid proglottides, is not reliable because there is considerable variation (Verster, 1967). Furthermore, it is not possible to distinguish between the ova of these two species (Kamalova, 1953).

Electrophoresis shows up small structural differences in isoenzymes which permit biochemical classification of species and sometimes even of strains within species. This procedure has been used as a tool to identify some parasites of vertebrates, for example trypanosomes (Steger et al., 1974; Kilgour & Godfrey, 1973; Bagster & Parr, 1973), *Leishmania* (Kilgour et al., 1974), *Plasmodium* (Carter, 1970, 1973), *Entamoeba* (Reeves & Bischoff, 1968) and ascarid worms (Zee & Zinkham, 1975). This report suggests that enzyme electrophoresis may also be used to distinguish taeniid material of human origin.

Materials and methods

During the course of a recent small survey in Nigeria, 44 specimens of *T. saginata* and seven of *T. solium* were collected. Nine *T. saginata* and two *T. solium* scoleces were present. The material was either obtained following treatment of the patients with male fern, mepancrine hydrochloride or niclosamide or was passed spontaneously. The larval cysticerci of *T. solium* were also obtained from pork in Nigeria and those of *T. saginata* from calves experimentally infected in the U.K. with eggs obtained from Kenya. Fresh material was prepared for immediate use by homogenizing it in ten volumes of physiological saline. Other preparations were homogenized in water containing 1 mM of each of the enzyme stabilizers E.D.T.A., dithiothreitol and *l*-aminocaproic acid (Kilgour & Godfrey, 1973), which were then stored at +5°C or −20°C. Additional preparations were made in the same way from whole worms stored in saline and antibiotics at −20°C (100 units Penicillin G, 100 mg dihydrostreptomycin and 100 units nystatin per ml saline). Centrifugation at 100,000 g for 30 minutes at +4°C of some samples gave no difference in the electrophoretic results. Other samples were allowed to sediment overnight at 4°C, only the supernatant being retained for analysis.

Electrophoresis by the thin-layer starch gel method (Wranall & Culliford, 1968) was used, as modified by Kilgour & Godfrey (1973). Glucose phosphate isomerase (E.C. No. 5, 3, 1, 9) was located by reduction of tetrazolium salt to give its blue formazan insoluble precipitate at the site of enzyme activity in the gel (Delorenzo & Ruddle, 1968), 20 ml of the solution containing the reagents and 1-4% agar, was allowed to solidify over the gel and the whole then incubated at 37°C until development of bands occurred.

Results

Up to seven equidistant bands were seen with each of the two tapeworm species, but fewer bands were more usually seen. Extracts from all tapeworms of one species were identical in mobility but the number of bands detected was determined by the activity of the enzyme in the specimen. No differences attributable to the method of collection or preparation of the specimens were seen. Other methods of preservation may result in loss of banding even in enzymically active samples but the overall difference in mobility remains. With both *T. solium* and *T. saginata* extracts prepared from either strobila or cysticerci had identical mobility.

At pH 7-4, the band nearest the point of application was the strongest band and was visible if any enzyme activity was present. The mobility of this band only was used as the criterion for comparison. Differences in mobility between the two species can be seen in Fig. 1.

Discussion

Enzyme electrophoresis of glucose phosphate isomerase appears to distinguish between *T. saginata* and *T. solium* clearly and consistently, provided the material is preserved correctly. It therefore has advantages over identification based on morphological features, which may vary or be difficult to see, and it may be used to identify small fragments of segments found in stool specimens.

Further studies will be required to ascertain whether these species derived from other parts of the world show...
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Fig. 1. Isoenzymes of glucose phosphate isomerase at pH 7.4. On the top T. solium and on the bottom T. saginata. Sample contained in 8 mm lengths of cotton thread seen at the origin. Movement of the bands from thread towards anode. Enzyme activity of each sample approximately 1 U ml⁻¹. Voltage 330V across a 15 cm gel of 1 mm thickness. Current 20 mA. Time 3 hours. Gel buffer 0.015M phosphate pH 7.4. Electrode buffer 0.2M phosphate pH 7.4.

the same electrophoretic mobilities and whether differences can be shown between the taeniid worms of canine origin.

References


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