

SOME ASPECTS OF THE GLUCOSE METABOLISM OF FASCIOLA GIGANTICA

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**Summary:** *F. gigantica* obtained from experimentally infected sheep, were incubated aerobically for three hours in glucose containing medium.

Glucose consumption and acetic acid production by *F. gigantica* were measured.

The means of glucose consumption and acetic acid production in 10 incubations were  $298,6 \pm 10,39$  nmoles/mg protein/hour and  $156,7 \pm 10,53$  nmoles/mg protein/hour respectively.

**Fasciola Gigantica'da glikoz metabolizması üzerinde arařtırmalar**

**Özet:** Eksperimental olarak enfekte edilmiş koyunlardan elde edilen *F. giganticalar* aerobik olarak glikoz ihtiva eden ortamda 3 saat süre ile inkube edildiler. *F. gigantica* tarafından kullanılan glukoz ve ortamda teşekkül eden asetik asit miktarları ölçüldü; glukoz kullanımı ve asetik asit teşekkülü ortalamaları saatte ve miligram proteinde olmak üzere sırasıyla  $298,6 \pm 10,39$  nanomol ve  $156,7 \pm 10,53$  nanomol olarak bulundu.

**Introduction**

*F. gigantica* is a parasite belonging to the class of trematodes. In the adult phase of its life cycle, it lives mainly in the liver of cattle, sheep and buffaloes. Fascioliasis caused by *F. gigantica* is a serious disease in Turkey (5).

Glucose is the main energy source of many parasitic helminths (9). Carbohydrate dissimilatory pathways in most helminths differ from the corresponding pathway in mammalian tissues. Unlike the host tissues, the parasitic worms are not capable of the complete oxidation of substrates. Since oxidations are incomplete, fermentation products always accumulate.

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These products differ both qualitatively and quantitatively with each parasite. Therefore each animal should be the subject of separate detailed investigation. In the energy-producing pathways, considerable variations exist not only from one helminth to another, but also within the developmental stages of a single helminth (8).

Although several investigations concerning the intermediary metabolism of the *F. hepatica* have been carried out (1,5,6,12), the data on this subject for *F. gigantica* is limited. Goil (4) determined lactic acid as one of the end products of carbohydrate metabolism of *F. gigantica*.

The principle end products of glucose metabolism in *F. hepatica* are propionate, acetate and carbon dioxide and minor amounts of L-lactate, succinate and iso-valerate (11).

In the present paper we are reporting glucose consumption and acetic acid production by *F. gigantica* obtained from experimentally infected sheep.

### Materials and Methods

Adult *F. gigantica* used in our experiment were obtained by the following procedures. The eggs of *F. gigantica* were collected from the gall bladders of naturally infected buffaloes and cattle at slaughterhouses of Adana. *Limnea auriculariae* which were collected from the same area, were infected with the miracidiae after hatching of the eggs. Each of one year old male merino sheep were infected orally with 100 metacercariae. The liver flukes were isolated after 18 weeks from the bile ducts of freshly slaughtered sheep. They were immediately transferred to a solution containing (mM); NaCl, 120; KCl, 4; CaCl<sub>2</sub>, 0.9; MgSO<sub>4</sub>, 2.4; Na HCO<sub>3</sub>, 18; glucose, 5.5; sodium phosphate buffer (pH 7.5) 4. To one lt of medium 10<sup>6</sup> units penicillin and 100 mg streptomycin were added (7).

Since adult liver flukes may survive for several days in a simple salt solution containing glucose (11), parasites were incubated at 37°C for 24 hours in the same medium. The solution was changed three times in this period and the *F. gigantica* with empty caeca were used in the experiment. At the end of this period they were kept 2 hours in the standard medium containing the components same as incubation medium except glucose, penicillin and streptomycin.

The 10 parasites were placed to each flask of 20 ml. standard medium having 5 mM glucose.

Ten incubation flasks were closed and incubated at 37°C in a shaking water bath for 3 hours. The samples from flasks were taken one hour intervals for analysis of glucose and acetic acid.

The kit for enzymatic determination of glucose (bio Merieux France) was used in glucose assay.

For acetic acid determination, the kit for determination of acetic acid in food stuffs (Boehringer, Mannheim) was used.

At the termination of incubation period, the parasites were removed from the medium and homogenized, protein contents determined in the homogenates according to the method of Cleland and Slater (2). Protei-trol of bio. Merieux was used as protein standard.

### Results

The results of the incubation of intact *F. gigantica* aerobically are presented in table 1 and 2.

Table 1. The glucose consumption by *F. gigantica* (In each experiment 10 *F. gigantica* were incubated in 20 ml. medium for 3 hours).

Experiment	nmole/mg. protein/hour
1	306
2	286
3	283
4	293
5	310
6	266
7	243
8	323
9	363
10	313
Mean	298.6 ± 10.39
Range	243-363

As shown in tables, glucose consumption by the parasites ranged from 243 to 363 nmoles/mg protein/hour and acetic acid production from 116 to 221 nmoles/mg protein/hour.

Table 2. The acetic production by *F. gigantica* (In each experiment 10 *F. gigantica* were incubated in 20 ml. medium for 3 hours).

Experiment	nmole/mg protein/hour
1	135
2	116
3	132
4	150.5
5	158.3
6	133.3
7	140.6
8	221
9	184
10	196.3
Mean	$156.7 \pm 10.53$
Range	116-221

### Discussion

Under the experimental conditions we used, acetic acid was found as an end product of glucose metabolism in *F. gigantica*. The mean glucose consumption by the parasite was  $298.6 \pm 10.39$  nmols/mg protein/hour and the mean acetic acid production was  $156.7 \pm 10.53$  nmols/mg protein/hour.

Vugt and Meer (10) found 475 nmols/mg protein/hour glucose consumption and 137 nmols/mg protein/hour acetic acid production by *F. hepatica*. The difference of glucose consumption between these two *Fasciola* species is in accord with the observation that small sized animals generally have a higher rate of metabolic activity.

Goil (4) has investigated 0.46 % fresh weight lactic acid production by *F. gigantica* in the incubation with glycogen.

Propionic, acetic, lactic, succinic acids and carbon dioxide were found as the end products of glucose metabolism in *F. hepatica* (3).

The observations suggest that *F. gigantica* has a similar pathway of carbohydrate metabolism with *F. hepatica* at least qualitatively in respect of some of the end products of glucose metabolism.

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