SUMMARY

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The salient points emerging from these studies are as follows:

1] Most of the glycolytic enzymes, e.g., hexokinase, phosphoglucoisomerase, pyruvate kinase and lactate dehydrogenase, follow almost similar pattern of development. But excepting lactate dehydrogenase, which showed highest activity during the later period of gestation, all these enzymes mentioned above show a peak at 25-28 weeks of gestation. And they also exhibit high level of activity at early stage i.e. at 13-20 weeks of gestation of human fetal heart. In adult cardiac tissue the activity of the glycolytic enzyme is very low.

2] Phosphofructokinase activity in human fetal heart is found to be maximum during 13-16 weeks of gestation which decreases thereafter.

3] Aldolase follows almost similar pattern of development as that of phosphofructokinase up to 17-20 weeks of gestation, but its pattern changes abruptly thereafter, showing a peak at later period of gestation. In adult heart tissue the activity is very low.

4] On the basis of the above, it can be said that, EM pathway of glucose metabolism is active in human fetal
heart providing energy for cellular differentiation and maintenance, required for its proper functioning. The capacity to metabolize glucose increase with increase in gestational ages. Low activity of glycolytic enzymes in adult cardiac tissue may suggest dependence on metabolism other than glycolysis.

5) Isoenzymatic study of lactate dehydrogenase in human fetal and adult heart, indicates that there is a gradual transition from anaerobic to aerobic metabolism as heart matures, which is evident from increase in the activity of LDH$_1$ and LDH$_2$ and decrease in LDH$_4$ and LDH$_5$.

6) Enzymes related to TCA cycle, viz. isocitrate dehydrogenase (both NAD$^+$ and NADP$^+$ dependent), $\alpha$-ketoglutarate dehydrogenase and succinate dehydrogenase have low levels of activities at initial stages of development and rise significantly as fetal heart matures, indicating a greater dependence on oxidative metabolism for its survival. In adult heart these activities are very high. Furthermore, this findings of increasing activities of oxidative enzymes is also corroborated with the present histological studies which reveal that cardiac muscle fibre content increases with progression of gestation.
All the enzymes related to pentose phosphate pathway viz. glucose-6-phosphate dehydrogenase, 6-phosphogluconate dehydrogenase and transketolase, follow almost similar pattern of development during fetal life. They exhibited highest activity during early period of gestation in human fetal heart, distinctly at 13-16 weeks. In adult heart all the activities are very low.

Thus, it is clear that, the pentose phosphate pathway is active in fetal heart mainly during the early period to generate NADPH and pentoses necessary for synthetic purposes during cellular development.

In human fetal heart glycogen content and glycogen synthetase activity are highest during early fetal life and decreases gradually as it approaches term. α-D-glucosidase activity increases gradually up to 25-28 weeks of gestation, but decreases thereafter as the heart matures. In the case of glycogen phosphorylase the activity does not change significantly throughout the gestation.

Thus, on the basis of the above findings, it can be said that the human fetal heart is very much dependent on glucose metabolism.
All the pathways of glucose metabolism, e.g., glycolytic pathway, citric acid cycle and pentose phosphate pathway are active in human fetal heart, but their contribution to overall glucose metabolism depend on the stage of fetus. In addition to this, fetal heart has a glycogen store and has the ability to synthesize glycogen and can utilize it also.

10] In addition to the above, distinct characteristic differences of cardiac metabolism in adult, suggests that the cardiac tissue may utilize energy sources other than glucose.

11] Aspirin under in vitro condition inhibits the activities of hexokinase, lactate dehydrogenase, glucose-6-phosphate dehydrogenase, 6-phosphogluconate dehydrogenase and succinate dehydrogenase in a dose dependent manner. Thereby suggesting that, it may affect fetal cardiac energy metabolism and may lead to metabolic teratogenesis and developmental abnormalities.

12] Though in vitro study does not always reflect exact in vivo situation, yet it can be said, aspirin medication during pregnancy may cause disturbances in fetal heart development, which may be either due to direct action of the drug or due to environmental changes produced by
the drug. Hence aspirin medication, by pregnant woman, during organogenesis in early gestational age may manifest later some derangement in form or in function within the context of the formation of viable baby. The end result will deviate from the normal pattern of differentiation and maturation of the particular organ in human fetus.