The effects of various n-3 and n-6 polyunsaturated fatty acids on the secretion of insulin-like growth factor-I by MC3T3-E1 osteoblast-like cells

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The purpose of this pilot study was to test the hypothesis that polyunsaturated fatty acids (PUFAs) increase the secretion of insulin-like growth factor-I (IGF-I) by osteoblasts. The PUFAs used included docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) both members of the n-3 PUFA family as well arachidonic acid (AA) and gammalinolenic acid (GLA) of the n-6 PUFA family.

IGF’s are autocrine as well as paracrine stimulators of osteoblast proliferation. Increased osteoblast proliferation could lead to increased bone mineralisation and a possible reduced risk of osteoporotic fractures.

Aim

The effects of the various PUFAs on IGF-I secretion as well as cell morphology

Method

MC3T3-E1 cells were seeded and pre-incubated for 24 hrs

Following this the cells were exposed to AA and GLA (n-6) as well as EPA and DHA (n-3) PUFAs at a concentration of 20 ug/ml

In some cases indomethacin (a COX blocker) was added 45 min prior to AA exposure

After an exposure period of 24 hrs the media were harvested and stored at 70°C

Finally an ELISA was performed to determine IGF-I concentrations and cell numbers were determined by means of a standardized crystal violet staining method

Included as controls were: ethanol (vehicle) at 0.1%, Prostaglandin E (PGE), a metabolite of AA and IGF-I stimulator. Parathyroid hormone (0.01 uM)

Results

The various factors playing a role in bone formation and breakdown. GH=Growth Hormone, IGF=Insulin like growth factor

Discussion

• Parathyroid hormone (PTH) was one of the positive controls used in this experiment as it is a known stimulator of IGF-I secretion. PTH increased IGF-I levels in this experiment confirming the experimental set up.

• Compared to the control the PUFAs all stimulated IGF-I secretion with the n-3 family having the greatest effect.

• Prostaglandin E (PGE) did not stimulate secretion as expected, this could be due to the fact that the concentration used was not optimal for this model.

Conclusion

• It appears as if the PUFAs do increase IGF-I secretion, with the n-3 PUFAs exhibiting the largest effect

• The levels detected were however very low, for this reason the duration of the experiment will be increased and the medium supplemented with osteogenic factors to allow for maturation and mineralisation of the osteoblasts prior to PUFA exposure

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