ABSTRACT

In a normal, healthy rod outer segment 40% to 50% of the phospholipid acyl chains consist of docosahexaenoic acid (DHA, 22:6n3). Diets that are deficient in n3, or ω-3, fatty acids lead to the replacement of 22:6n-3 with 22:5n-6. Dietary n-3 deficiency is from the change in phospholipid hydrolysis. The formation of DHA in the rod outer segment is from rho to disk membrane. Acyl chain packing in the rod outer segment is from rho to disk membrane.

METHODS

Visual signal transduction begins when light is absorbed by rhodopsin, as shown in FIGURE 1 below. A series of photoreaction steps are then catalyzed by intracellular proteins of visual signal transduction as described in Schlichting and Reichardt (1982). The rate of rhodopsin to active G protein (GTP binding) is measured by rhodopsin fluorescence quenching. The formation of both MII and the MII-G complex from rhodopsin is from the empirical model-free analysis. Both parameters show that DPH rotates significantly slower in 22:5n-6 than in the two n3 lipids.

RESULTS

Membrane Properties

The kinetics of MII and MII-G complex formation results from the diffusion of both proteins in the plane of the membrane. To what extent is this kinetics subject to changes in the specific bond configuration of 22-carbon fatty acids and the apo- or zwitterionic form of the protein?

Rhodopsin Function

Effect of temperature on the MI - MII conformational equilibrium of photo-activated rhodopsin. At lower temperature the extent of MI formation is the same in all 3 bilayers, but at physiological temperature the amount of MII formed is significantly higher in the two n3 lipids.

PDE Activity

Dose-response curves showing the effect of increasing rhodopsin bleach on PDE activity. The conformation of the curves at bleach levels above ~5% indicates that at these saturating ‘dose’ levels all available cGMP is hydrolyzed. The only physiologically relevant bleach level in this series is the one at bleach level 0.05006.

SUMMARY & CONCLUSIONS

1. The motion of DPH in the membrane is altered by the double bond configuration of a 22-carbon fatty acid at the sn-2 position.

REFERENCES