

Natural immunity to influenza infection in mice is impaired by a fish oil diet

PM Byleveld¹, GT Pang², RL Clancy², DCK Roberts¹

¹Discipline of Nutrition and Dietetics, University of Newcastle, NSW, 2308

²Discipline of Pathology, University of Newcastle, NSW, 2308

Diets containing fish oil have been shown to alter immunological responses including cytokine production and resistance to infection. The present studies were conducted to test the hypothesis that a fish oil diet would result in a greater severity of infection and impaired immunological responses after exposure to influenza virus in naturally infected and immunised mice.

One hundred and twenty SPF male BALB/c mice assigned to diets containing either fish oil or beef tallow (20% fat, w/w) and after 14 days were intra-nasally infected with live influenza virus (A/Qld). Twenty mice from each diet group were sacrificed at days two, five and seven after infection to determine the degree of virus clearance from the lungs (by MDCK plaque assay) and the relative proportion of lung lymph node CD4⁺ and CD8⁺ T lymphocyte sub-sets (by flow cytometry).

The greatest severity of infection was observed at day five with the fish oil group clearing less virus from the lungs, losing more weight and consuming less food (shown below).

Diet	Pre-infection Food consumption (g/d)	Post-infection (day 5) Food consumption (g/d)	Virus concentration (log ₁₀ PFU/mL)	Weight change (%)
Fish oil	4.3±0.1	1.5±0.4 * a	3.42±0.22 *	-8.18±3.03 *
Beef tallow	4.6±0.1	3.2±0.4	2.79±0.14	+1.06±1.24

* significantly different to beef tallow group P<0.05

a significantly different to pre-infection food consumption P<0.05

At this time there were more macrophages in the lung of the fish oil fed mice which suggests a greater severity of infection. There was no significant difference in the proportions of CD4⁺ and CD8⁺ T lymphocytes at any time point after infection.

In a second experiment 20 mice assigned to fish oil or beef tallow diets received an intra-peritoneal immunisation with influenza virus at day seven and were killed at day 14. The splenocytes from the fish oil group showed significantly greater proliferation to the virus (stimulation index 148.7±28.8) than splenocytes from the beef tallow group (56.8±17.3) (P<0.05). There was also a trend for the proliferative response to Con A to be greater in the fish oil group.

We have previously reported that there was no significant difference in the titers of influenza specific antibodies in infected, orally immunised mice fed fish oil or beef tallow (1). In the same experiment there was no difference in the clearance of virus between dietary groups.

Although natural immunity was impaired in fish oil fed mice these effects were not seen in orally immunised mice. The increased proliferative response to viral stimulation in intra-peritoneally immunised, fish oil fed mice suggests that this diet may improve some immune responses perhaps by increasing antigen presenting cell function. The results suggest that immune response to influenza infection may be mediated by different mechanisms in naturally infected (naive) and immunised mice.

1. Byleveld PM, Grissell T, Pang GT, Beagley KW, Roberts DCK. The effect of dietary fat type on lymphocyte proliferation and antibody production. Proc Nutr Soc Aust 1996;20:88.