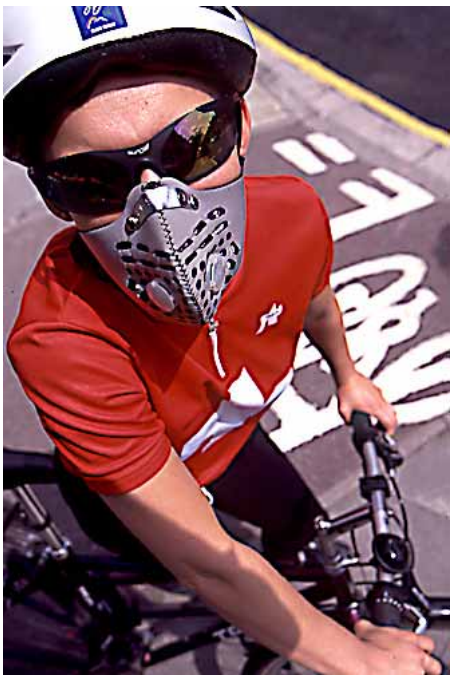
Cycling Research

EVERY BREATH YOU TAKE...

Motor vehicles generate a lot of pollution, with far-reaching health effects. In New Zealand, vehicle emissions have been blamed for ~400 premature deaths every year (see Fisher *et al* 2002 for more details). Many would-be cyclists are put off by the prospect of being exposed to all those traffic fumes, while still others don face-masks when riding. So is it really that bad to cycle in such environments?



The simple answer is yes: if you have the choice between cycling along a remote park path and a busy urban arterial then the former will definitely be more pleasant and safer on your lungs. Bevan *et al* (1991) measured respirable particle concentrations in Southampton (UK) for bicycle commuters. They found that exposure to particles while cycling along a busy city centre street was about nine times higher than when cycling around common parkland. Kingham *et al* (1998) had similar findings in Huddersfield (UK), with exposure levels to benzene and particulates about double for cyclists on the road compared with a canal pathway.

However, when it comes to the choice between biking at all or (say) driving instead, then the decision is not so clear-cut. It is often assumed that cyclists (and pedestrians) are exposed to higher air pollution levels than motor vehicle occupants because they are physically unprotected. However various studies (e.g. van Wijnen *et al* 1995) have found that, in slow moving traffic, typical of 'rush hour' traffic, car occupants can be exposed to higher pollutant levels.

ETA (1997) reviewed over sixty studies of pollution exposure by different transport modes, and found that cars offer little or no protection against the pollutants generated by traffic. Most of the studies indicated that motor vehicle occupants face pollution levels inside a car two to three times higher than those experienced by pedestrians and cyclists, with larger public transport vehicles somewhere in between. The table below summarises the relative exposure (compared with "background" levels) to various pollutants.

Typical Ratios of average concentrations to background levels by transport mode

Pollutant	Pedestrians/ Cyclists	Bus Users	Car Users
Volatile Organic Compounds (VOCs) e.g. benzene	2	3 - 4	4 - 6
Carbon Monoxide (CO)	2 - 2.5	3 - 4	4 - 5
Nitrogen Dioxide (NO2)	1.5 – 2	2	3
Particles	Some increase - figures uncertain		

More recent research has repeated the general trend. For example, Kingham *et al* (1998) compared different modes on the same commuter journey and showed that car drivers will be exposed to about four times as much benzene and 25% more particulates than cyclists on the same road. And Rank *et al* (2001) came to similar conclusions, using teams of two cyclists and two car drivers all equipped with personal air samplers while driving in the morning traffic of Copenhagen. The concentrations of particles and VOCs in the cabin of the cars were 2-4 times greater than in the cyclists' breathing zone, the greatest difference being for VOCs.

In many ways it's not hard to understand why motorists might be more affected by traffic pollution. Many dangerous emissions are heavier than air, so tend to stay near the ground. Therefore a driver in a low-profile vehicle (particularly when their air vents are even lower) is more exposed than a cyclist sitting upright on a bike. Car ventilation systems set to external intake also help more emissions get inside the vehicle (and "recirculate" mode may be simply keeping them in there). Also, interestingly, many newer cars also emit various toxic substances from the materials within the vehicle (e.g. vinyls) - so much for a safe haven!

OK, but what about the fact that the typical cyclist is breathing harder as they pedal? In theory, differing levels of respiration will impact on the actual amount of pollution an individual takes in.

The study by van Wijnen *et al* (1995) showed a respiratory average of 2.3 times higher for cyclists compared with car drivers. Using the figures from the above table, this would put them no worse than on par with motorists. Increased travel time could also increase a cyclist's exposure but, as has been demonstrated regularly in commuter challenges, in peak-hour traffic cyclists generally don't take any longer to get to their destination.

In conclusion, cyclists (or would-be ones) can ride off with some comfort that they are not overly exposed to the various motor vehicle emissions, certainly compared with car occupants. By taking advantage of routes away from busy roads, and maybe even wearing a face mask, their exposure levels will be even lower. And of course they will be helping to reduce the pollution in the first place!

References

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