Obese lung functions are at higher risk of ozone exposure

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A new study provides the first evidence that people with higher body mass index (BMI) may have a greater response to ozone than leaner people. Short-term exposure to atmospheric ozone has long been known to cause a temporary drop in lung function in many people. BMI is the ratio between height and weight frequently used to classify individuals as underweight, overweight or normal weight.
A new study provides the first evidence that people with higher body mass index (BMI) may have a greater response to ozone than leaner people. Short-term exposure to atmospheric ozone has long been known to cause a temporary drop in lung function in many people. BMI is the ratio between height and weight frequently used to classify individuals as underweight, overweight or normal weight.

There are respiratory physiologic changes in obesity and thereby causes difficulty in control of breathing. Prevalence of several types of life threatening risk are stratified according to BMI. They are:

- Self-reported wheeze,
- Risk for venous thromboembolism,
- Asthma, pulmonary embolism,
- Pulmonary arterial hypertension,
- Dilated & thickened pulmonary artery with plaques on a gross lung,
- Obesity Hypoventilation Syndrome (OHS),
- Obstructive Sleep Apnea (OSA),
- Radiology in the critically ill obese... etc.

This is the first study in humans to look at whether body weight influenced how much lung function falls after acute ozone exposure. Ozone is formed in the atmosphere in the presence of sunlight from other pollutants emitted from vehicles and other sources. Exposure occurs when people inhale air containing ozone.

It is known that about 97 million adults in the United States are overweight or obese. Obesity and overweight substantially increase the risk of morbidity from hypertension; dyslipidemia; type 2 diabetes; coronary heart disease; stroke; gallbladder disease; osteoarthritis; sleep apnea and respiratory problems; and endometrial, breast, prostate, and colon cancers. Higher body weights are also associated with increases in all-cause mortality.

Researchers at the National Institute of Environmental Health Sciences (NIEHS), part of the National Institutes of Health, the University of North Carolina (UNC) at Chapel Hill, and the U.S. Environmental Protection Agency (EPA) analyzed data on young (18–35 years), healthy, non-smoking men and women to see if BMI — a measure of the amount of fat a person has — had an effect on lung response to acute ozone exposure. The study published this month in the journal Inhalation Toxicology found that ozone response was greater with increasing BMI.

"It has been known for a long time that in response to short-term exposure to ozone lung function tends to temporarily drop in many people. There has recently been interest in why some people's lung function drops more than others — age and perhaps genetics, as well as diet may play a role," said NIEHS researcher and co-author Stephanie London, M.D. "We were intrigued by recent mouse studies that showed that obesity increases lung responses to ozone and wanted to see whether this applied in humans."

A collapsed lung (atelectasis) for obesity may be due to compression of the lung tissue or obstruction of the air passages (bronchi). The collapse may affect only a small part of the lung or the whole lung.

Researchers at the University of Verona studied the relationship between body mass and lung function in older men and found a strong relationship between body composition, fat distribution, and lung function in elderly men. Researchers concluded that a small reduction in body mass might lead to significant improvement in lung function. The study was published in the issue of the American Journal of Clinical Nutrition.

"Obesity, low physical activity, and menstrual irregularity are risk factors in airway pathology”, according to the Journal of Allergy and Clinical Immunology.

Another combined study by China and Taiwan nation hospital also found similar result and suggested that obesity and metabolic syndrome were associated with impaired lung function in adults in Taiwan. Our results imply that obesity and insulin resistance may be the common pathways underlying lung function impairment and metabolic syndrome.

To examine the question of whether higher body mass index influences ozone responses in humans, the investigators took advantage of an earlier study led by Milan J. Hazucha and colleagues at the Center for Environmental Medicine, Asthma and Lung Biology /UNC and the USEPA Human Studies Facility in Chapel Hill, N.C. From this study, BMI was determined in 197 subjects who had been exposed to ozone for 90 minutes, during which they alternated 20 minutes of exercise with 10 minutes of rest. The subjects' lung capacity and function were tested immediately before and after the exposure period using spirometry, a basic lung function test that measures the speed and volume of how fast and how

much air is breathed out of the lungs.

In general, the higher the BMI, the greater the ozone response, providing one more reason why maintaining a healthy body weight is important to your health. When subjects were put into categories of body fatness defined by the US Centers for Disease Control based on their BMI, the ozone-related drops in lung function, particularly the forced expiratory volume in one second (FEV1), were lowest in underweight people (BMI less than 18.5), greater in normal weight people (BMI 18.5 to 25) and greatest in overweight individuals (BMI above 25). BMI is a measure of fatness based on an individual's height and weight.

"It's notable that these results came out of a study that was done in a population of predominantly normal weight individuals," said London. "This suggests that these effects may be even more important in the general population where there are large proportions of overweight and obese individuals." An estimated two-thirds of U.S. adults are overweight or obese, with a BMI greater than 25, according to CDC[i].

The physiologic mechanisms responsible for the decline in lung function after ozone exposure with increasing BMI are not clear, although the authors suggest that perhaps circulatory hormones and other inflammatory factors may play a role. These factors have been shown to affect airway hyper-responsiveness and inflammation in animal models.

The authors note too that the study was limited in the small number of obese individuals (the subjects had not been selected with a study of BMI in mind) and by having only one measure of a person's body fat. Future studies of the effects of obesity on ozone response, they say, should include a targeted pool of obese and lower weight subjects, as well as measures of central adiposity such as waist circumference, given that fat deposited centrally may have a greater influence on an individual's respiratory response to ozone.

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