Researchers find link between food odors and lifespan in fruit flies

February 1 2007

Researchers hoping to learn why organisms tend to live longer if their intake of calories is restricted have made a startling discovery – in fruit flies, just the smell of food can have a negative effect on longevity.

Scientists have known for decades that restricted dietary intake can increase the lifespan of many species, but the mechanism that causes this is not understood. Short-lived organisms like the fruit fly, Drosophila melanogaster, are studied to help unravel this mystery, and the knowledge gained could have important implications for human health.

In a paper to be published in *Science*, the journal of the American Association for the Advancement of Science, a group of researchers from Baylor College of Medicine in Houston, New Mexico State University in Las Cruces and the University of Houston report that exposure to food odors can modulate lifespan and partially reverse the longevity-extending effects of dietary restriction in fruit flies.

"Not only can they not have their cake – they can't smell their cake" without shortening their lifespans, said Wayne Van Voorhees, a faculty member in the Molecular Biology Program at New Mexico State University and a member of the research collaboration.

The researchers, led by Scott Pletcher of the Huffington Center on Aging at Baylor, measured the lifespans of different strains of fruit flies in the presence and absence of food odors – specifically live yeast, which is an important component of the flies' diets. Exposure to food

odors reduced lifespan in flies that had been subjected to dietary restriction. The reductions ranged from 6 percent to 18 percent – not as much reduction as actual consumption of more food caused, but significant enough to show that food odors have a modulating effect on lifespan.

The researchers also studied genetically altered strains of fruit flies to determine whether loss of olfactory function – the sense of smell – had an effect on lifespan. They found that in all cases, the longevity of the mutant flies was considerably greater than their wild-type controls.

The paper will be published by *Science Express* on Feb. 1.

Van Voorhies did the metabolic measurements for the study, using sensitive detectors in his laboratory at NMSU to analyze the aerobic respiration of the tiny flies. Carefully controlling the flow and oxygen content of air flowing to the flies in sealed systems, he can determine the flies' metabolic rates by analyzing the carbon dioxide they give off.

At the cellular level, this metabolic process is essentially the same in all organisms. Fruit flies and other short-lived organisms make useful "model organisms" for studies such as this because studying humans is impractical, Van Voorhies noted.

"If you are studying longevity, by definition the study is going to take longer than the lifespan of the researcher," he said.

Van Voorhies said metabolic studies of the fruit flies showed that longer lifespans in those subjected to caloric restriction were not simply a result of slower metabolism.

"A simple way to get a fruit fly to live longer is to put it at lower temperatures," he said. "It will live longer but everything is going slower

in the animal, so you haven't fundamentally altered the way it has aged. So we wanted to make sure the effect of caloric restriction wasn't just slowing the animals down, and we found that it wasn't. You can have a high metabolic rate and be long-lived, and that's an encouraging observation."

Ultimately, understanding any link between human longevity and caloric intake, and the role our sense of smell may play in the process, will require more knowledge of the fundamental mechanisms at work, Van Voorhies said.

"You continue to work on the model organisms to try to figure out what the actual mechanism is, and then you can try to apply it to people," he said. "The pharmaceutical companies would like to be able to mimic the beneficial effects of caloric restriction by having you take a pill. But for that to work, you need to understand the mechanism by which caloric restriction extends longevity."

Sometimes – as in the new discovery of a link between food odors and lifespan in fruit flies – the questions get more complicated as scientists gain more knowledge.

Researchers hoping to learn why organisms tend to live longer if their intake of calories is restricted have made a startling discovery – in fruit flies, just the smell of food can have a negative effect on longevity.

Scientists have known for decades that restricted dietary intake can increase the lifespan of many species, but the mechanism that causes this is not understood. Short-lived organisms like the fruit fly, Drosophila melanogaster, are studied to help unravel this mystery, and the knowledge gained could have important implications for human health.

In a paper to be published in Science, the journal of the American

Association for the Advancement of Science, a group of researchers from Baylor College of Medicine in Houston, New Mexico State University in Las Cruces and the University of Houston report that exposure to food odors can modulate lifespan and partially reverse the longevity-extending effects of dietary restriction in fruit flies.

"Not only can they not have their cake – they can't smell their cake" without shortening their lifespans, said Wayne Van Voorhees, a faculty member in the Molecular Biology Program at New Mexico State University and a member of the research collaboration.

The researchers, led by Scott Pletcher of the Huffington Center on Aging at Baylor, measured the lifespans of different strains of fruit flies in the presence and absence of food odors – specifically live yeast, which is an important component of the flies' diets. Exposure to food odors reduced lifespan in flies that had been subjected to dietary restriction. The reductions ranged from 6 percent to 18 percent – not as much reduction as actual consumption of more food caused, but significant enough to show that food odors have a modulating effect on lifespan.

The researchers also studied genetically altered strains of fruit flies to determine whether loss of olfactory function – the sense of smell – had an effect on lifespan. They found that in all cases, the longevity of the mutant flies was considerably greater than their wild-type controls.

The paper will be published by Science Express, an online publication of the AAAS, on Feb. 1. Science Express is used for rapid publication of selected research papers that are published later in the print version of Science.

Van Voorhies did the metabolic measurements for the study, using sensitive detectors in his laboratory at NMSU to analyze the aerobic

respiration of the tiny flies. Carefully controlling the flow and oxygen content of air flowing to the flies in sealed systems, he can determine the flies' metabolic rates by analyzing the carbon dioxide they give off.

At the cellular level, this metabolic process is essentially the same in all organisms. Fruit flies and other short-lived organisms make useful "model organisms" for studies such as this because studying humans is impractical, Van Voorhies noted.

"If you are studying longevity, by definition the study is going to take longer than the lifespan of the researcher," he said.

Van Voorhies said metabolic studies of the fruit flies showed that longer lifespans in those subjected to caloric restriction were not simply a result of slower metabolism.

"A simple way to get a fruit fly to live longer is to put it at lower temperatures," he said. "It will live longer but everything is going slower in the animal, so you haven't fundamentally altered the way it has aged. So we wanted to make sure the effect of caloric restriction wasn't just slowing the animals down, and we found that it wasn't. You can have a high metabolic rate and be long-lived, and that's an encouraging observation."

Ultimately, understanding any link between human longevity and caloric intake, and the role our sense of smell may play in the process, will require more knowledge of the fundamental mechanisms at work, Van Voorhies said.

"You continue to work on the model organisms to try to figure out what the actual mechanism is, and then you can try to apply it to people," he said. "The pharmaceutical companies would like to be able to mimic the beneficial effects of caloric restriction by having you take a pill. But for

that to work, you need to understand the mechanism by which caloric restriction extends longevity."

Sometimes – as in the new discovery of a link between food odors and lifespan in fruit flies – the questions get more complicated as scientists gain more knowledge.

Source: New Mexico State University