Informing communities – a collaborative investigation of Native American PAH dietary exposure scenarios and possible risks to human health

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Oregon State University Superfund Research Program: PAHs - New Technologies and Emerging Health Risks
Engagement CORE project goals

Establish a collaborative project that includes the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) tribal agencies, tribal and university investigators, and tribal community members to better understand health risks associated with PAH exposure on the Reservation and assist in human capacity building with tribal partners.

CTUIR specific requests:
- PAH exposure from traditional smoking practices
- PAH concentrations in traditionally smoked foods
- Tribal member engagement in research (CBPR)
CTUIR geographic location
History of collaboration between OSU and CTUIR

  https://www.box.com/shared/70r3579u5gh7ysdugfv7

• Signed MOU in place

• Several pilot projects

• NIEHS-P42ES016465 (2009-2013) “Tribal-University Collaboration to Address Tribal Exposures to PAHs and Improve Community Health”
Educating OSU community about Tribal research issues

OSU Tribal Research Symposium - April 2010

• Issues/perspectives related to research in Tribal communities

• Included Tribal legal issues, research ethics, concepts in indigenous and western science, integration of socio-cultural health indicators into Tribal risk research.

• Featured speakers from CTUIR and Swinomish Tribal Community and tribal legal scholar

• Bi-directional capacity building

• Presentation and speaker details:
  http://oregonstate.edu/superfund/outreachevents
Community based participatory research (CBPR)

- Collaborative determination of:
  - Research aims beneficial to community
  - Data collection, analysis, validation
  - Publication options
  - Data ownership/intellectual property rights

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Background

- Community based concerns
- PAHs occur in combustion emissions
- Traditional meat smoking techniques

Carcinogenic PAHs

Non-carcinogenic PAHs
Study objectives

1. Characterize the effect of CTUIR smoking method on polycyclic aromatic hydrocarbon (PAH) content in smoked salmon

2. Compare traditionally smoked salmon PAH levels to PAHs in commercially smoked salmon.

3. Estimate potential risks from consumption of traditionally smoked salmon.
Study design

- Two-factors considered
  - Smoking structure - tipi or shed
  - Wood type - apple or alder
- Smoked salmon prepared as if to be eaten!
- Non-smoked salmon control
- 3 different commercial smoked salmon
Study execution – salmon smoking

- 10 non-smoked salmon sub-samples/event → -10°C
- 10 fillets/ smoking method
- Apple wood followed by alder wood
Study execution – post smoking

- Fillets in amber glass jars and stored at -10°C
- Transported on ice to OSU Food Safety and Environmental Stewardship Laboratory (-20°C)
- Salmon analyzed for 33 PAHs by GC-MS

Determination of Parent and Substituted Polycyclic Aromatic Hydrocarbons in High-Fat Salmon Using a Modified QuEChERS Extraction, Dispersive SPE and GC–MS

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PAH content in apple wood smoked salmon

Non-carcinogenic

Carcinogenic

[PAH]Salmon [g kg⁻¹ w.w.]

Tipi

Shed

SRP – Forsberg & Harding
PAH content in alder wood smoked salmon

Non-carcinogenic

Carcinogenic

[PAH] Salmon (g kg⁻¹ w.w.)

X X X X X X

X X X X X X

X X X X

X X X X
• PAHs by number of rings: $3 > 2 \approx 4 > 5$
• Non-carcinogenic $\sim 90\%$, carcinogenic $\sim 10\%$
• No treatment related effect (two-way ANOVA, interaction $p$-value $< 0.001$)
PAHs in CTUIR smoked salmon vs commercial smoked salmon

- PAH levels were $140 - 430$ in CTUIR smoked salmon
- $\Sigma$PAH levels in commercial smoked salmon similar to non-smoked CTUIR salmon

Salmon samples analyzed ($n = 75$)
Estimated hazard indexes for smoked salmon ingestion (mean ± SEM, n = 10)

<table>
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<th>Tipi-apple</th>
<th>Shed-apple</th>
<th>Tipi-alder</th>
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5 gpd
300 gpd

SRP – Forsberg & Harding
Estimated cancer risks for smoked salmon ingestion (mean ± SEM, n = 10)

Excess Cancer Risk (above 1 x 10^{-6})

- Tipi-apple
- Shed-apple
- Tipi-alder
- Shed-alder

SRP – Forsberg & Harding
Contribution of carcinogenic PAHs to BAPeqs.

- Benzo[a]pyrene, fluoranthene and benzo[b]fluor. greatest contributors
- Levels were in excess of criteria
Communicating results

**Completed:**
- Conducted focus groups with tribal members
- In-person meetings between OSU and CTUIR investigators
- Tribal Advisory Committee presentations and discussions
- Published technical results

**On-going:**
- Crafting message for tribal community – sensitive to cultural traditions
- Likely provide nuanced advice → ultimately tribal community’s choice to take action
- CTUIR Health Commission and Advisory Committee interest in understanding indoor sources of PAHs
Key Points

• Trusting relationship between university and tribal researchers necessary for successful collaborative research.

• University researchers /trainees should become familiar with tribal research issues and CBPR principles if engaging in research with tribes.

• Material and data sharing agreements explicitly state agreed-on processes and benefits to community and university partners.

• Collaborative research has opened doors for other tribal exposure/health issues to be explored.
Acknowledgments

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CTUIR Participants and Fisherman

Tribal Advisory Committee members: Michelle Burke (CTUIR)

OSU staff: Kristin Pierre, Ricky Scott, Jorge Padilla, Kevin Hobbie, Oleksii Motorykin, Lane Tidwell

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