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Effectiveness of Educational and Psychological Messaging Interventions to Improve Safe Fish Consumption Knowledge and Behaviors Among Asian Women of Childbearing Age

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Abstract

Background: We evaluated the effectiveness of an intervention to reduce contaminant exposure from fish consumption among Asian women of childbearing age residing in the Milwaukee, Wisconsin, area.

Methods: Women of childbearing age were randomized to group 1, no intervention; group 2, educational messaging only; or group 3, educational messaging plus a motivational self-affirmation component. Then, we compared safe fish consumption knowledge, intentions, and behaviors among groups.

Results: Among 123 participants, groups 2 and 3 were more likely than group 1 to report “eating fewer fish meals” to reduce exposure to contaminants (group 2 odds ratio [OR] 1.42; 95% CI, 0.59–3.44; group 3 OR 2.76; 95% CI, 1.12–7.03).

Discussion: Self-affirmation messaging can enhance educational messaging to increase safe fish consumption among Asian women of childbearing age.

BACKGROUND

Fish contain key nutrients and are recommended as part of a healthy diet to support fetal neurodevelopment during pregnancy.¹ However, fish consumption might result in fetal exposure to contaminants, including mercury, perfluoroalkyl and polyfluoroalkyl substances (PFAS), and polychlorinated biphenyls (PCBs).¹ The US Food and Drug Administration (FDA), Environmental Protection Agency (EPA),¹ and Wisconsin Department of Natural Resources (DNR)^{2,3} have issued advisories to practice safe fish preparation methods and avoid consuming certain fish species. Several freshwater bodies near Milwaukee, Wisconsin,

are designated as an Area of Concern because of contaminant levels and have additional consumption advisories.³

Asians individuals residing in the United States had higher reported fish consumption than other racial/ethnic groups⁴ and might be at higher risk for mercury, PFAS, or PCB contaminant exposure from fish.⁵ To better understand fish advisory awareness and consumption behaviors among Asian women of childbearing age (WCBA), we conducted a focus group and quantitative survey. Most focus group participants had not heard of specific advisories.⁶ Those who expressed greater self-efficacy (ie, the belief that they could make desired changes to their behavior) were more willing to follow advisories.⁶ Among survey respondents, only 40.5% had heard of any fish consumption advisories.⁷ These findings demonstrated a need for interventions to increase Asian WCBA's awareness of fish advisories and willingness to follow them.

In this evaluation, we assessed whether educational messaging with or without a motivational self-affirmation component can increase perceived self-efficacy⁸ and lead to improved fish advisory awareness and safer fish consumption behaviors.

METHODS

Eligibility and Recruitment

We recruited participants through convenience and snowball sampling. Community advisory group members, schools, DNR listservs, and community organizations distributed recruitment materials to potentially eligible persons. We also asked participants who completed the survey to recruit additional participants within their social networks.

Interested persons used a hyperlink on the recruitment materials to complete a REDCap (Research Electronic Data Capture) screening survey. Eligible participants must have met the following screening criteria: (1) resided ≥ 1 year in Milwaukee, Waukesha, Washington, or Ozaukee counties; (2) female; (3) self-identified as Chinese, Filipino, Hmong, or Karen; (4) aged 18 to 50 years; (5) had consumed ≥ 1 meal of fish caught by the participant or by someone the participant knows from waterbodies in Wisconsin in the last 12 months; (6) the only member of their household to participate in the telephone survey; and (7) had not participated in a previous project about fish consumption with the Wisconsin Department of Health Services. Participants completed survey instruments in their preferred language, which included English, Chinese, Hmong, or Karen.

Procedures

After screening, we randomized participants 1:1:1 to group 1 (no intervention), group 2 (educational messaging only), or group 3 (educational and motivational self-affirmation messaging). All participants completed a baseline REDCap survey. Within that survey, groups 2 and 3 completed the intervention components. After the interventions, all participants completed additional survey items in the same survey instrument. One month later, participants were sent a follow-up survey through REDCap. Each participant received \$30 and \$20 gift cards after completing the baseline survey and 1-month follow-up survey, respectively. This activity was reviewed by the Centers for Disease Control and Prevention

(CDC), deemed not research, and conducted consistent with applicable federal law and CDC policy (45 CFR part 46.102(l)(2), 21 CFR part 56; 42 USC Sect 241(d); 5 USC Sect 552a; 44 USC Sect. 3501 et seq).

Intervention Components

Educational Messages: Groups 2 and 3 read health messages, including recommendations from the FDA, EPA, and Wisconsin DNR.^{1-3,9} Participants read through infographics showing healthy fish serving sizes for children and adults and fish preparation methods to reduce chemical exposure. Graphics also showed fresh-caught and storebought fish species categorized as “up to 2 meals per week,” “up to 1 meal per week,” “up to 1 meal per month,” and “do not eat.” A final message included general advice for reducing contaminant exposure in fresh-caught fish (eg, “choose smaller, younger fish”) (Appendices 1 and 2).

Self-Affirmation Messages: Immediately before they saw the educational messages, group 3 completed a self-affirmation exercise. In self-affirmation interventions, participants are presented with reminders of their values to affirm a positive self-image. These reminders might increase perceived self-efficacy and willingness to adopt desired behaviors.¹⁰ To remind participants of their values, we asked each participant to respond to a series of items about their motivations. Each participant selected from a list of statements that “best represents what is most important to you when deciding how and what you eat.” Their selection prompted a nested list of new value statements related to their first choice. They selected a statement from this second list, then answered open-ended questions about why their chosen statement reflected their values (Appendices 1 and 2).

Survey Items

We collected demographic information and baseline fish consumption behaviors. A full list of survey items is available in Appendix 2. Immediately after the intervention, groups 2 and 3 reported whether they intended to make certain behavior changes (eg, “eat 1 to 2 servings [but not more] of fish every week”) in the next 30 days.

One month after the initial survey and intervention, we reassessed how frequently participants had consumed local, fresh-caught, and storebought fish. Using the same items as the baseline survey, participants were asked how frequently they consumed certain fish parts and used different fish preparation methods. Participants reported whether they had made changes to their fish consumption habits in the past month. Groups 2 and 3 reported how frequently they intended to follow messages from the educational intervention.

Statistical Analysis

We calculated descriptive statistics of participant demographics, baseline fish consumption habits, and advisory awareness. We fit unadjusted logistic regression models to calculate odds ratios (OR) for differences among groups in postintervention intentions, reported behavior changes, fish consumption habits, and fish preparation methods at 1 month follow-up. For each model, the dependent variable was the 1-month survey item of interest, and the independent variable was the intervention group, with group 1 as the reference. For

analysis, we focused on fish consumption habits and preparation methods mentioned in the educational materials as either increasing (ie, consuming the skin, head, guts, organs, innards, or belly fat or using fish to make broth, stock, curry, or soup) or decreasing (ie, grilling or broiling fish) contaminant exposure. To maximize sample size in each category, any item with a range of responses was dichotomized for analysis (eg, a 6-point scale from “1 time in the last month” to “2 or more times per day” was reduced to “<1 time per week” vs “≥1 times per week”). We used R version 4.4.0 (R Core Team) for all analyses.

RESULTS

In total, 123 Asian women aged 20 to 50 years were survey participants. Thirty-eight participants were randomized to group 1, 43 to group 2, and 42 to group 3. Most participants were Hmong (n = 77, 63%), followed by Karen (n = 17, 14%), Chinese (n = 15, 12%), and Filipino (n = 14, 11%). Nearly all (n = 111, 90%) participants chose to complete the survey in English. Most participants had at least an associate degree (61%) (Table 1).

Most participants in the intervention groups reported intentions to follow educational messages. Immediately after the intervention, 77% of group 2 and 79% of group 3 reported they planned to “eat 1 to 2 servings (but not more) of fish every week.” Likewise, 91% to 93% said they planned to “choose to eat types (species) of fish that are lower in chemicals, like mercury” and “clean or cook fish using ways that may lower the amount of chemicals.” However, because group 1 did not answer these items, it is unclear whether the interventions improved participant intentions.

After 1 month, 77% of group 2 and 76% of group 3 reported they intended to follow the educational messages from the intervention (Table 2). Group 3 had higher odds than group 1 of reporting most behavior changes in the past 30 days, including “eating fewer fish meals” (OR 2.76; 95% CI, 1.12–7.03), “eating different types or species of fish” (OR 1.82; 95% CI, 0.75–4.47), and “avoided eating fish from some fishing locations” (OR 3.13; 95% CI, 1.25–8.22). Groups 2 and 3 reported eating the skin, head, guts, and belly fat of fish less often than group 1 (Table 2).

DISCUSSION

In this behavioral intervention of Asian WCBA in the Milwaukee area, we found motivational self-affirmation and educational messaging improved fish advisory awareness and safer fish consumption behaviors. Both groups 2 and 3 reported less frequent use of higher-contaminant fish preparation methods than group 1. These results are encouraging evidence that educational messaging might reduce these communities’ contaminant exposure from fish consumption. Group 3 was more likely than group 1 to report behavior changes to avoid contaminants from fish, indicating self-affirmation interventions are also beneficial. In keeping with our previous findings, intervention components designed to increase both fish advisory knowledge and self-efficacy increased safe fish consumption behaviors.

Maternal exposure to mercury, PFAS, and PCB contamination may lead to adverse birth outcomes and impact cognitive and reproductive health in infants.² Our team’s prior studies found that a sample of mostly White, mostly male Milwaukee-area anglers had

elevated contaminant levels, and in Wisconsin, Asian people have higher incidence of severe maternal morbidity and low birthweight than comparator groups.^{11,12} Although these poor outcomes are likely multifactorial, limiting contaminant exposure from eating fish in Asian WCBA in the Milwaukee area may improve maternal and child health and reduce these health disparities. Clinicians and public health practitioners can use these combined educational and self-affirmation materials to reduce contaminant exposure from fish consumption in this community.

Limitations

Our smaller-than-intended sample size ($n = 201$) limits inference. Second, surveys and intervention materials required internet access and fluency in written English, Hmong, Chinese, or Karen, which might have excluded some eligible persons. Third, responses were self-reported and subject to social desirability bias. Lastly, we followed participants for only 1 month, so durability of our findings is unknown.

CONCLUSIONS

This behavioral intervention was associated with increased safe fish consumption behaviors among Asian WCBA in the Milwaukee area. Self-affirmation paired with educational messaging might be a valuable tool to reduce contaminant exposure from fish in this population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgement:

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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Table 1.

Demographic Characteristics and Baseline Fish Consumption and Preparation Behavior Among 123 Asian Women of Childbearing Age by Intervention Condition – Milwaukee, Wisconsin, June 7, 2023–February 24, 2023

	Overall (n=123)	Group 1 ^a (n = 38)	Group 2 ^b (n = 43)	Group 3 ^c (n = 42)
Age, years; mean (SD)	32 (7.7)	31 (6.9)	33 (8.2)	33 (7.8)
Years living in the Milwaukee area, mean (SD)	3.5 (0.87)	3.5 (0.86)	3.5 (0.88)	3.5 (0.89)
Household size, mean (SD)	4.3 (2.0)	4.7 (2.3)	4.1 (1.7)	4.1 (2.0)
Number of children in household, mean (SD)	1.5 (1.6)	1.4 (1.7)	1.6 (1.6)	1.6 (1.4)
Ethnicity, n (%)				
Chinese	15 (12)	3 (8)	9 (21)	3 (7)
Filipino	14 (11)	5 (13)	5 (12)	4 (10)
Hmong	77 (63)	25 (66)	22 (51)	30 (71)
Karen	17 (14)	5 (13)	7 (16)	5 (12)
Survey language, n (%)				
English	111 (90)	37 (97)	34 (79)	40 (95)
Karen	6 (5)	1 (3)	5 (12)	0 (0)
Chinese	1 (1)	0 (0)	1 (2)	0 (0)
Hmoob or Hmong	5 (4)	0 (0)	3 (7)	2 (5)
Educational attainment, n (%)				
Some college or less	46 (39)	11 (31)	17 (40)	18 (44)
Associate degree or more	72 (61)	24 (69)	25 (60)	23 (56)
Fish consumption and behaviors				
Local wild-caught fish meal frequency in the last month, n (%)				
1 time in the last month	105 (85)	31 (82)	38 (88)	36 (86)
2 or 3 times in the last month	17 (14)	6 (16)	5 (12)	6 (14)
Storebought fish meal frequency in the last month, n (%)				
1 time in the last month	89 (72)	28 (74)	29 (67)	32 (76)
2 or 3 times in the last month	33 (27)	9 (24)	14 (33)	10 (24)
Have you ever: n (%)				
Eaten fewer fish meals	66 (54)	20 (53)	24 (56)	22 (52)

	Overall (n=123)	Group 1 ^a (n = 38)	Group 2 ^b (n = 43)	Group 3 ^c (n = 42)
Eaten different types or species of fish	73 (59)	25 (66)	23 (53)	25 (60)
Avoided eating certain parts of fish (head, fat, belly, skin)	61 (50)	20 (53)	19 (44)	22 (52)
Avoided eating fish from some fishing locations	75 (61)	24 (63)	25 (58)	26 (62)
Consuming fish parts that contain more fat (sometimes or more frequently), n (%)				
Skin	96 (78)	28 (74)	33 (77)	35 (83)
Head	83 (67)	26 (68)	29 (67)	28 (67)
Guts, organs, or other innards	20 (16)	9 (24)	4 (9)	7 (17)
Belly fat	51 (41)	16 (42)	15 (35)	20 (48)
Fish preparation methods that can trap fat and increase contaminant exposure (sometimes or more frequently), n (%)				
Use fish or fish parts to make broth, stock, curry, or soup	58 (47)	20 (53)	17 (40)	21 (50)
Fish preparation methods that reduce contaminant exposure, n (%)				
Grill or roast	109 (89)	31 (82)	38 (88)	40 (95)

^a Group 1: No intervention components (control group).

^b Group 2: Educational interventions only.

^c Group 3: Self-affirmation and educational interventions.

Table 2.

Participant Fish Consumption Intentions, Consumption Behaviors, and Preparation Methods—Milwaukee, Wisconsin, June 7, 2023–February 24, 2023
Abbreviation: OR, odds ratio.

	Group 1 ^a (n = 38)		Group 2 ^b (n = 43)		Group 3 ^c (n = 42)	
Postintervention Intentions (Yes)	n (%)	OR (95% CI)	n (%)	OR (95% CI)	n (%)	OR (95% CI)
Eat 1 to 2 servings (but not more) of fish every week	N/A ^d	N/A ^d	33 (77)	Ref	33 (79)	1.11 (0.40–3.14)
Choose to eat types (species) of fish that are lower in chemicals, like mercury	N/A ^d	N/A ^d	39 (91)	Ref	39 (93)	1.33 (0.28–7.14)
Clean or cook fish using ways that may lower the amount of chemicals	N/A ^d	N/A ^d	40 (93)	Ref	39 (93)	0.98 (0.17–5.55)
Behaviors at 1-month follow-up	n (%)	OR (95% CI)	n (%)	OR (95% CI)	n (%)	OR (95% CI)
Intention to follow educational messages (n: sometimes or more frequently)	N/A ^d	N/A ^d	33 (77)	Ref	32 (76)	0.97 (0.35–2.67)
Behavior changes in the past month (n: Yes)						
Eaten fewer fish meals	17 (45)	Ref	23 (53)	1.42 (0.59–3.44)	29 (69)	2.76 (1.12–7.03)
Eaten different types or species of fish	17 (45)	Ref	18 (42)	0.89 (0.47–2.15)	25 (60)	1.82 (0.75–4.47)
Avoided eating certain parts of fish (head, fat, belly, skin)	21 (55)	Ref	31 (72)	2.09 (0.84–5.37)	27 (64)	1.46 (0.59–3.61)
Avoided eating fish from some fishing locations	18 (47)	Ref	30 (70)	2.56 (1.04–6.51)	31 (74)	3.13 (1.25–8.22)
Specific fish consumption behaviors						
Consuming fish parts that contain more fat (n: sometimes or more frequently)						
Skin	27 (71)	Ref	26 (60)	0.69 (0.25–1.81)	22 (52)	0.54 (0.19–1.81)
Head	25 (66)	Ref	13 (30)	0.23 (0.09–0.59)	12 (29)	0.23 (0.08–0.60)
Guts, organs, or other innards	6 (16)	Ref	3 (7)	0.42 (0.08–1.73)	4 (10)	0.63 (0.15–2.40)
Belly fat	18 (47)	Ref	10 (23)	0.35 (0.13–0.91)	9 (21)	0.34 (0.12–0.89)
Fish preparation methods that might trap fat and increase contaminant exposure						
Use fish or fish parts to make broth, stock, curry, or soup (n: sometimes or more frequently)	22 (58)	Ref	11 (26)	0.26 (0.10–0.66)	12 (29)	0.32 (0.12–0.83)
Fish preparation method that might reduce contaminant exposure						
Grill or broil fish (n: sometimes or more frequently)	28 (74)	Ref	30 (70)	0.96 (0.34–2.74)	26 (62)	0.76 (0.27–2.13)

^aGroup 1: No intervention components (control group).

^bGroup 2: Educational interventions only.

^cGroup 3: Self-affirmation and educational interventions.

^dGroup 1 was not asked items regarding postintervention intentions.