



Fish consumption among women anglers of childbearing age in the Great Lakes region



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ABSTRACT

Fish consumption advisories are issued by the federal government for women of childbearing age (WCBA). These advisories make recommendations about the amount and types of fish that should be consumed to provide the greatest health benefits to women and their children while avoiding risks from chemical contaminants. We used diary methods to study fish consumption patterns of 1395 WCBA in the Great Lakes coastal region who purchased fishing licenses, a group which has significant opportunity to eat larger quantities of fish. Very few members of this group reported exceeding the federal recommendations for total fish consumption (between 3% and 5% depending on assumptions about portion sizes), consumption of canned “white” tuna (0%), or consumption of “do not eat” species (4%). They did report eating more fish on average than recent national study estimates, but they did not report consuming as much fish as is recommended to obtain the greatest health benefits of fish consumption. Only 10–12% of study participants reported eating within the recommended range of 8–12 oz. of fish per week, with 84–87% eating less than the recommended amount. Additional efforts are likely needed to encourage WCBA to eat more low-risk fish, even among this group of higher-than-average fish consumers.

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1. Introduction

Fish consumption advisories are issued by state, federal, and tribal agencies in part because of the potential health risks to women and their children from a variety of chemical contaminants (Turyk et al., 2012; Papadopoulou et al., 2014). These advisories recommend that women of childbearing age (WCBA) limit their consumption of certain fish. At the same time, many of these agencies recommend that women consume *more* low-risk fish, especially during and after pregnancy, emphasizing fish with lower concentrations of chemical contaminants, particularly mercury. Fish are the primary dietary source of omega-3 fatty acids, which are important for adult health (Domingo, 2014) as well as the development of eyes, brains, and nervous systems in the fetus (Innis, 2008).

Several agencies within the federal government offer advice to women. The United States Department of Agriculture (USDA) advises that “women who are pregnant or breastfeeding consume at least 8 and up to 12 ounces of a variety of seafood per week, from choices lower in methyl mercury” (USDA, 2010, p. 39). Current Environmental Protection Agency/Food and Drug Administration

(EPA/FDA) advice suggests that WCBA “eat up to 12 ounces (2 average meals) a week of a variety of fish and shellfish that are lower in mercury” (USEPA, 2004, p. 1). However, EPA/FDA are in the process of revising their recommendations to more closely follow the USDA advice. The draft advice proposed by the EPA/FDA suggests that WCBA “eat 8 to 12 ounces of a variety of fish each week” from choices that are lower in mercury (USFDA, 2014, p. 1). The key difference is a change from suggesting it is permissible for WCBA to eat *up to* 12 ounces to suggesting women *should* eat 8–12 ounces. This change encourages consumption.

Advice from all federal agencies suggests that WCBA limit their consumption of certain fish that are higher in mercury. The recommendation is to limit canned “white” tuna consumption to 6 oz. per week, and avoid consumption of four species of fish (swordfish, shark, tilefish, and king mackerel).

While all states offer advice about consumption of fish caught by anglers within state waters, some states also offer advice regarding purchased fish. This advice generally follows the federal recommendations but offers more details and suggestions about specific species to consume (e.g., MDHHS, n.d.). Some states provide more conservative advice than the federal government, particularly for the consumption of canned “white” tuna. For example, Minnesota and Wisconsin suggest one serving per month (MDH, n.d.; WDHS, 2008) compared to the federal advice of 6 oz. per week.

Several studies have found that most WCBA avoid consumption

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of the most contaminated fish (Lando et al., 2012; Silver et al., 2007), however they do not seem to be following the advice encouraging consumption of low-risk fish and therefore may be missing out on the benefits of fish consumption for themselves and their offspring. Connelly et al. (2014) found that almost all new mothers consume less fish during pregnancy than was recommended by USDA. Similarly, Lando et al. (2012) found in a national survey that on average, all major demographic groups of women, but especially pregnant women, ate less fish than was recommended. Among women who ate fish, the median intake was 1.8 oz/week for pregnant women, 2.5 oz/week for postpartum women, and 3.0 oz/week for WCBA who were not pregnant or postpartum. Each of these medians is far below the recommended 8–12 oz/week. Mahaffey et al. (2009) used National Health and Nutrition Examination Survey (NHANES) data from 1999 to 2004 to examine fish consumption patterns of WCBA (and their association with blood mercury levels). They found that WCBA in the Great Lakes coastal region ate less than 1 meal/week of fish on average, far below the recommended 2 meals/week. Based on more recent NHANES data (2009–2010), among those who ate fish nationwide, 60% ate less than 0.75 meals/week and 40% ate 0.75+ meals/week (EPA, 2013). A survey of Great Lakes states' residents found that among the 83% of women who ate fish, 6% consumed more than 2 meals per week, 14% consumed 1 to 2 meals/week, and the remaining 80% consumed less than 1 meal/week (Imm et al., 2005).

None of these studies specifically examined the fish consumption patterns of women who fish, however. Women anglers likely have additional opportunities to consume fish, including potential exposure to additional chemical contaminants found in the fish they catch. Their consumption rates are likely to be higher than women who do not fish. Knobloch et al. (2005) found that women who lived in a household where someone had a fishing license did eat more meals of sport-caught fish. Therefore, they may be more likely to get the benefits as well as be exposed to the risks of fish consumption.

We studied WCBA in the Great Lakes coastal region who purchased fishing licenses (and therefore have the opportunity to fish legally). Specifically, we recruited WCBA anglers who indicated that they consumed fish at least occasionally to participate in a diary study in which they reported their fish consumption behaviors. Because our objective was to describe the fish consumption habits of WCBA anglers living in this region, we did not include WCBA who did not eat fish. Among fish-consuming WCBA, this angler WCBA group may be likely to have higher levels of fish consumption than typical WCBA. Specifically, we examined how much and what types of fish they reported consuming and compared these levels with the USDA and (current and proposed) EPA/FDA recommendations.

2. Materials and methods

2.1. Sample selection and diary recruitment

We drew a sample of 15,000 fishing licenses sold to women aged 18 to 48 (who would reach a maximum age of 50 [considered the end of the childbearing years] at the end of our two-year study¹) who lived in counties bordering the Great Lakes (i.e., Great Lakes coastal region). We drew the sample by state in proportion to the number of licenses sold in each state to WCBA who lived in the Great Lakes coastal region.

We sent invitation letters to each member of the sample in

February 2014. The letter described the study and what would be required of participants. It also offered a financial incentive up to \$20 for participation in the project, and provided a link to a sign-up page on the Internet. We provided a postage-paid return postcard for people to opt out of the study because they did not eat fish, did not have regular Internet access, or were not interested in participating. We sent a follow-up letter to all invitees a week later encouraging participation.

We made telephone calls to those who did not sign-up or return a postcard to encourage participation and allow sign-up directly over the telephone. Calling ceased in a particular state when the quota of participants had been reached for that state. During the study sign-up process we obtained email addresses and then checked them by sending out a study participation verification email. Email was then used for all communication with study participants.

2.2. Diary data collection

We collected fish consumption information for 16 weeks from May 18 through September 6, 2014. Participants recorded data in two-week blocks. Participants could record information as many times as they wished during the two-week period. Every two weeks we sent an email invitation to participants to signal the start of the next two-week period and remind them that the previous two week-period was ending. When a two-week period ended, we sent up to three reminders to participants who had not completed entering data for the period to finish recording their information for the period. Participants earned financial incentives for each period completed and received a bonus at the end if they completed reporting for every period.

We gave each participant a link unique to them to access their personal fish consumption diary on the Internet. On the initial page, participants saw information for the eight two-week periods of the study, showing completed periods and incentives earned. On the next page we asked participants to record whether or not they ate fish on each day in the current two-week period. For each day they indicated they ate fish, another page opened asking the number of fish meals they had eaten on that day. For each meal reported, participants recorded whether the fish was purchased (at a store or restaurant) or sport-caught (i.e., fish caught by you or someone else), the species eaten, the portion size, and (for sport-caught fish) where the fish was caught. We provided a list of fish species, including the most commonly consumed purchased fish and those with consumption guideline recommendations, along with a text box to record species not on the list. For sport-caught species, we listed only those with consumption guideline recommendations and provided an "other" option. Participants indicated portion size in reference to a picture of a 6 oz. cooked (170 g) portion of salmon (Fig. 1); we asked participants if the meal they ate was larger, smaller, or the same size as the picture.

We obtained data on participant age from fishing license records. We gathered data on other socio-demographic characteristics, such as education and race, using an online survey conducted during the last 2-week period of diary data collection.²

2.3. Data analysis

Several previous studies have estimated the size of fish portions that people consume using pictures similar to those used in our study (Connelly et al., 1996; West et al., 1989) or plastic models (Silver et al., 2007). Since we provided a picture of a 6 oz. cooked salmon meal, we assumed those indicating an equivalent portion

¹ We report only data from the first year of the study in this paper.

² We did not ask if they fished during the study period.

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