



Original article

Female Inmates with Diabetes: Results from Changes in a Prison Food Environment



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ABSTRACT

Objective: The prevalence of diabetes among Oregon prison inmates has increased by 50% in the last 5 years. The Healthy Food Access Project (HFAP) was implemented in the minimum-security facility at the Oregon Coffee Creek Correctional Facility to reduce the risk of chronic disease (including diabetes) and improve nutrition among female prison inmates. The intervention reduced the menu from 3,000 to 2,200 calories per day and provided nutrition education. We evaluated the effectiveness of HFAP on female inmates with diabetes on two outcomes: the effect of the reduced calorie menu on glycemic control and other biometric measures, and the calories purchased from commissary foods.

Method: We conducted a quasiexperimental study among all female inmates with diabetes living at the prison on August 28, 2013. Exposed inmates resided in the minimum-security facility for a minimum of 90 days after August 1, 2012 (when a reduced calorie menu was implemented); unexposed inmates resided primarily or exclusively in the medium-security facility. Medical chart abstractions were conducted to collect biometric data and mixed effects models described the differences in biometric trends between exposed and unexposed participants. Commissary receipts were collected to measure calories purchased.

Results: Of the 63 female inmates with diabetes, 24 were exposed to the intervention and 39 were unexposed. Exposed inmates reduced their hemoglobin A1c levels by 0.04 percentage points per month compared with 0.01 percentage points per month among unexposed inmates. Changes in body mass index depended on the amount of time they had served at the prison. Participants purchased an average of 1,094 calories from the commissary per day. Exposed inmates did not purchase more calories from the commissary after HFAP implementation.

Conclusion: Exposure to HFAP supported modest improvement in glycemic control among female inmates with diabetes, and inmates exposed to HFAP did not purchase more calories from the commissary.

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Diabetes management in prisons has gained public interest as rates of both obesity and incarceration continue to increase in the United States (Leddy, Schulkin, & Power, 2009). Current sentencing guidelines increase the number of aging prisoners who are at higher risk of obesity and diabetes. In addition, the incidence of diabetes among younger people continues to increase parallel to the increase in obesity (Edwards, 2005; Lorber

et al., 2013). Over the past 5 years, the prevalence of diabetes among prison inmates in Oregon increased by 50% (Oregon Legislative Assembly Workgroup on Corrections Health Care Costs, 2014). The cost of diabetes management in prisons is financed entirely by the state government. In Oregon, the average custody duration is 39 months and costs \$100,500 per inmate; an estimated additional \$25,675 is spent annually on diabetes-related health care per inmate with diabetes (American Diabetes Association, 2013). Controlling diabetes and obesity-related conditions can reduce this financial burden and prevent diabetes-related morbidities in a high-risk population.

Female inmates are particularly at risk for diabetes. Obesity is more prevalent among female inmates compared with both nonincarcerated women and male inmates (Binswanger et al., 2010; Fickenscher, Lapidus, Silk-Walker, & Becker, 2001). In

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addition, the odds of diabetes among female inmates is twice the odds of diabetes among male inmates (Binswanger et al., 2010). No studies have been published that examine systemic change to improve health and reduce the risk of chronic disease among people in U.S. prisons (Hanson & Gray, 1997) and few studies examined health promotion programs in these settings (Clouse, Mannino, & Curd, 2012; Hanson, Long, White, & Nelson, 2006).

In Oregon, Coffee Creek Correctional Facility is the only female prison. The prison has two female facilities: the medium-security facility and the minimum-security facility. Before the study period, an average of 3,000 calories were served each day in both facilities, and the food served failed to meet recommended dietary reference intakes (Hansen, 2013). If a sedentary female inmate ate 75% of the food served each day, she would gain an estimated 47 pounds per year.¹

To address the health of female inmates, the Healthy Food Access Project (HFAP) aimed to improve nutrition for female inmates and teach them food-related skills in the minimum-security facility. The HFAP was established in 2011 as a collaboration between the Oregon Department of Corrections and local public health (both Oregon Public Health Division and Multnomah County Health Department). The HFAP has altered the food environment in the minimum-security facility primarily by implementing a reduced calorie menu that labeled the caloric content and incorporated garden produce into the meals. HFAP also offered small classes and training opportunities related to nutrition and gardening.

A reduced calorie menu was implemented in the minimum-security facility cafeteria on August 1, 2012. The daily menu was reduced by an average 800 calories per day (from 3,000 to 2,200), produce from the prison garden was incorporated into the menu, and menu boards labeled the calorie content of food served. The medium-security facility did not participate in the HFAP, and the medium-security facility menu remained at 3,000 calories per day after August 1, 2012.

The purpose of the larger HFAP project was to change the food environment inside a women's prison to improve health behaviors, decrease weight gain, and improve chronic disease management. This study aimed to assess the effects that changes in the food environment had on female inmates living with diabetes by:

- 1) Describing changes in glycemic control, body mass index (BMI), and lipids after the reduced calorie menu was implemented; and
- 2) Comparing the amount of calories purchased from commissary before and after the reduced calorie menu was implemented to assess whether the reduction in calories on the menu led women to purchase more calories from the commissary.

Methods

Study Design

We conducted a quasiexperimental study among female inmates at the prison. We compared changes in three biometric

measures between exposed and unexposed female inmates: glycemic control (as measured by hemoglobin A1c [HbA1c] levels), BMI, and cholesterol. For these comparisons, we used all measures taken during the 12 months before (August 2011–July 2012) and after (August 2012–August 2013) the intervention began in the minimum-security facility. We also assessed the number of calories purchased before and after the reduced calorie menu was implemented in the minimum-security facility and differences in the amount of calories purchased between exposed and unexposed women.

Study Population

All female inmates residing at the prison with a diabetes diagnosis on August 28, 2013, were included in the study.

Intervention Period

The reduced calorie menu was implemented in the minimum-security facility on August 1, 2012, and the sample was pulled on August 28, 2013.

Exposed Women

It is relatively common for women to move between the minimum- and medium-security facilities, so we reviewed housing assignments to measure level of exposure to HFAP. Female inmates with diabetes were considered “exposed” to HFAP if they resided in the minimum-security facility for at least 90 days after the reduced calorie menu was implemented. This 90-day cutoff for exposure is an evidence-based metric used to measure sustained dietary behavior change (Pelletier, Dion, Slovinec-D'Angelo, & Reid, 2004).

Medical Chart Abstractions

Abstractions were conducted by hand from paper medical charts inside the prison medical facility from August through October 2013. Information was obtained from medical history, physicals, and laboratory results. We abstracted information on age, race/ethnicity, prison intake date, length of sentence, height, weight, HbA1c level, and cholesterol levels. For participants with an invalid low-density lipoprotein (LDL) cholesterol result (triglycerides > 400 mg/dL), LDL cholesterol was estimated using the modified Friedewald Formula (Chen et al., 2010).

We collected baseline demographic and biometric measures (height, weight, HbA1c, and cholesterol) from the intake physical when an inmate was admitted to the prison. All biometric measures were collected from 12 months before the implementation of the reduced calorie menu in the minimum-security facility to 12 months after (August 28, 2011 to August 28, 2013).

Commissary Receipts

Weekly commissary orders provide an opportunity for inmates to purchase supplementary food. Most of the food offered from the commissary is comparable to convenience store snacks without the single serving packaging. Commissary items are purchased from inmate earnings or money added to individual accounts by family and friends. Weekly paper commissary receipts were obtained for all study participants from the prison's medical staff for the months of June 2012 and June 2013. The name, size, price, and quantity of each purchased item were recorded. To assess the caloric content of commissary food,

¹ Weight gain is calculated from the U.S. Department of Agriculture estimated calorie need of 1,800 calories a day for a sedentary female 31 to 50 years old (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010): Weight gain = $(3,000 \times 0.75) - 1,800 = 450$ extra calories a day $(3,500/450) = 7.78$ days to gain 1 pound or $(365.25/7.78) = 46.95$ pounds a year.

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