DOES GARDENING PROTECT AGAINST NON-ALCOHOLIC FATTY LIVER DISEASE? RESULTS FROM A STUDY IN WINKLER, MANITOBA

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Home for the Summer Program, June 2019
Morden, Manitoba
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Does gardening protect against non-alcoholic fatty liver disease?

Results from a study in Winkler, Manitoba

Abstract

Introduction. Non-alcoholic fatty liver disease (NAFLD) affects approximately one quarter of the global population and is an increasing cause of liver disease and liver failure. Low physical activity and poor diet are risk factors for the development of NAFLD. Given the fact that gardening is associated with lower BMI, longer life and lower cardiovascular disease, it may be protective against NAFLD.

Methods. Using a dataset collected from adults living in or near Winkler, Manitoba, the association between gardening and NAFLD was assessed using a chi-squared test (n=302). Interviews were conducted with 23 gardeners to determine the intensity of their gardening activities and reasons why they garden. The relationship between intensity of gardening activity and NAFLD was tested using Welch's t-tests.

Results. In the large dataset, no association was found between NAFLD and having a garden. From the interviews, gardens who had a higher intensity of gardening (based on garden size, time spent in garden, number of crops grown, and number of meals/week containing something from the garden) tended to have lower levels of NAFLD, although no association was statistically significant. People garden for enjoyment, health and many other reasons, and everyone except one participant found that their garden positively impacts their health.

Conclusion. Intensive gardening may be protective against NAFLD. Given the fact that NAFLD treatment is currently based on lifestyle modification and weight loss, gardening programs may provide a valuable treatment option for those with NAFLD.

Introduction

Non-alcoholic fatty liver disease (NAFLD) is one of the drivers of the new chronic liver disease epidemic, and in the next decades it is expected to become the leading cause of end-stage liver disease.[1] Prevalence rates increased from 15% in 2005 to 25% in 2010. NAFLD is associated with the obesity epidemic, even though a significant portion of people with NAFLD are lean.

Development of NAFLD has a genetic component, but aside from genetics the most important risk factors are diet, physical activity, and socioeconomic status.[1] In fact,

treatment of NAFLD with lifestyle modification (weight reduction, Mediterranean diet, and exercise) can resolve non-alcoholic steatosis (NASH) and reduce fibrosis. Gardening is an hobby that requires physical activity and produces healthy food. In light of the evidence that increasing physical activity and improving diet are important in the treatment of NAFLD, investigating the relationship between gardening and NAFLD could yield interesting results.

Very little research has been done on the impact of gardening on development of non-alcoholic fatty liver disease (NAFLD). However, evidence from related fields suggests gardening could be beneficial in the prevention or treatment of NAFLD. A meta-analysis in 2003 showed gardening decreases BMI.[2,3] High levels of gardening have also been shown to increase life expectancy in men by 2.7 years, and increase cardiovascular-disease-free life expectancy by 2 years.[4] As obesity is a risk-factor for NAFLD, and cardiovascular disease (CVD) has some of the same risk factors, a similar association between gardening and NAFLD could exist. Therefore, the purpose of this research project is to investigate the relationship between gardening and NAFLD in a population of adults from Winkler, Manitoba.

Methods

This project was part of a large ongoing study on NAFLD in the Winkler area. Participants were recruited to the study through advertisements in local newspapers, on the clinic website, through physicians at the clinic, and at local fairs. In order to be included in the study participants had to be at least 18 years old and come from the Winkler area. Participants answered a questionnaire about their health status, diet, physical activity (International Physical Activity Questionnaire, IPAQ), whether they garden, and types of food grown in the garden (herbs, vegetables, berries, fruits). Height and weight measurements were taken and ultrasound was performed to determine the presence of fatty liver. Bloodwork was analyzed for glucose, lipids, liver function and liver enzymes. Physical activity level (high, medium, low) was calculated using self-reported activity levels from the IPAQ.

Characteristics of gardeners (gender, age, physical activity level, BMI, education level) were assessed using Welch's t-test for continuous data, and chi-squared tests for categorical variables.

Associations between NAFLD and gardening, gender, age, physical activity, BMI, education level, and gardening were assessed using Welch's t-test for continuous variables,

and Chi-squared test for categorical variables. A multiple logistic regression model was constructed using variables which were associated with NAFLD at the $p < 0.10$ level.

At one data collection clinic, interviews were conducted with 23 participants who garden. Questions included: amount of time spent gardening, size of garden, what is grown in garden, the reasons why people garden, and perceived health impact of gardening. These data were analyzed using Welch's t test to determine if there is an association between intensity of gardening and NAFLD. Reasons for gardening and perceived health impact were coded by theme and analyzed for patterns.

Results

Gardeners were more likely to be female, older in age, have lower BMI, and were more physically active (Table 1). Only physical activity level was statistically significantly different between the gardening and non-gardening group.

Table 1. Comparison of characteristics of gardeners and non-gardeners

Characteristic	Gardeners	Non-gardeners	p-value
Age	53.5	51.7	0.33
Physical activity (METS/week)	2485.3	1561.5	0.005*
BMI	30.4	31.6	0.18
Gender	63.8% of females 54.7% of males	36.2% of females 45.3% of males	0.19

The chi-squared test showed no association between gardening and whether or not someone had NAFLD (p=0.95). Chi-squared tests also showed no association between number of categories of food grown in the garden (herbs, vegetables, berries, fruits) and NAFLD (p=0.26).

Twenty-three interviews with gardeners were conducted. These interviews showed great heterogeneity among intensivity of gardening. Some people spent "hardly any time at all" in the garden, whereas others spent hours each day (range from 20 minutes/week to 25 hours/week). Garden sizes varied from one vegetable box (10 square feet) to a quarter hectare (26910 square feet). People grew 3 to 21 different items in their gardens. Furthermore, four women and one man recorded that they have a garden, but when they

were interviewed they said their spouse does all the work in the garden. These four women said that they canned and cooked the food from the garden, but their husbands did the outdoors work. Interestingly, one person who wrote down that they did not have a garden answered that they did have a garden when asked verbally. When interviewed, it turned out his garden was 125 square feet, which is larger than 7 of the gardens other people reported.

It also became apparent that gardening is not static. Three of the people interviewed had just changed their garden status. Two were in their first year of gardening, while one had significantly downsized their garden this year. One person who did not have a garden said that they had always had a large garden until this year.

People reported numerous reasons why they garden (Table 2). The most common answer was simply that they enjoy it (6 responses). Controlling the chemicals that go into their food was the second most common answer (5 responses). People also valued the freshness of garden food, and several people gardened because of habit or because their parents did. One person said that gardening is "part of life" and that people will think you're lazy if you don't have a garden. Mental health was another reason people garden. As one woman said, "Gardening is good for the soul."

The most common perceived health benefits of gardening included: eating fresh vegetables, improved mental health, getting exercise, and having chemical-free food (Table 2).

Table 2. Reasons why people garden and perceived health benefits of their garden.
Numbers indicate how many people mentioned each concept.

Why people garden	**Perceived health benefits of gardening**
Pleasure (15) Enjoyment (6) Beneficial for mental health (3) Hobby (3) Tasty produce (3)	Provides fresh vegetables (9) Mental health (5) Exercise (5) Chemical-free food (4) Control sugar/sodium in food (1) Vitamin D from sunlight (1) No health benefit (1)
Health (11) To control chemicals that go into food (5) Garden food is fresher (4) To get healthy food (2)	
Other (8) Habit/tradition (4) Spouse likes gardening (2)	

Cheaper than grocery store (2)	

Data from the interviews showed that gardeners without fatty liver were more likely to have larger gardens, spend more time in their garden, eat more meals from their garden, and grow a wider variety of crops. None of these reached statistical significance, although this is not surprising given the sample size of 23.

Table 3. Comparison of gardening intensity in gardeners with and without fatty liver. P-values were derived from Welch's two sample t test with the assumption of unequal variance. Sample size = 23.

	No fatty liver	Fatty liver	p-value
Time spent in garden (minutes/week)	370.5	231.4	0.45
Number of items grown	11.0	9.1	0.45
Size of garden (square feet)	6745.4	5758.9	0.81
Meals from garden	8.3	6.7	0.54

Discussion, limitations and future directions

This study showed that while self-reported gardening does not have an association with NAFLD, more intensive gardening may be protective against the disease. More interviews will be necessary to determine whether this relationship becomes statistically significant with a larger sample size. The protective effect of gardening on obesity and CVD suggests that gardening may also protect against NAFLD.[3,4]

If a protective association between intensive gardening and NAFLD is found, further studies could look at the feasibility and effectiveness of gardening programs for the treatment of NAFLD. Studies have shown gardening to be an effective health intervention in other contexts. For example, gardening programs increase vegetable consumption in children while nutrition education programs do not,[5] and gardening is beneficial in the treatment of mental illness.[6] Given that the current treatment for NAFLD is lifestyle modification, gardening presents an important treatment option. Lifestyle interventions rely

heavily on education, and the evidence suggests that gardening may be more effective than education in actually changing behaviour. A study on the impact of a gardening intervention in an adult population would be necessary to determine the effectiveness of gardening in this context.

Of course, gardening as a health intervention has limitations. In Winkler, gardens are typically grown from May – early September, although the season can be extended to last from April – early November. During the winter months, gardeners must find other forms of physical activity, and other ways to maintain healthy eating habits.

Finally, the interviews showed that the importance of gardening goes beyond mere physical activity and fresh vegetables. The most common reason people gave for gardening is that they enjoy it, and they lit up in the interviews as they talked about their gardens. In the context of Winkler, where many people garden and many gardeners have NAFLD, gardening could provide a valuable in-road for the treatment and prevention of NAFLD. Communities centred around activities people love tend to be strong communities, and gardeners with NAFLD could be support each other to make lifestyle changes conducive to treating NAFLD.

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