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The Use of Routine Periodic Fasting to Lower the Incidence of Type 2 Diabetes Mellitus

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The Use of Routine Periodic Fasting to Lower the Incidence of Type 2 Diabetes Mellitus

Abstract

Background: Diabetes mellitus is one of the most common chronic diseases in America and is associated with a number of severe complications including kidney failure, worsening of arteriosclerosis, an increased risk of heart attack and stroke, and loss of vision. The clinical course of diabetes supports the principle that once a patient is diagnosed with type 2 diabetes mellitus there is very little that can be done to reverse the disease process. This knowledge should put prevention of type 2 diabetes not only on the forefront of clinical practice but also of research. One such method of prevention currently being studied is routine periodic fasting. This review addresses the research associated with incidence of diabetes in populations that routinely fast.

Methods: Exhaustive search of available medical literature using MEDLINE-Ovid, MEDLINE-PubMed, CINAHL, and Web of Science was conducted. The following keywords were used: intermittent fasting, alternate day fasting, routine periodic fasting, intermittent energy deprivation, calorie restriction, diabetes, prediabetes, prediabetic state, type 2 diabetes, and diabetes mellitus. The articles were evaluated and assessed for quality using GRADE.

Results: Seventy-six articles were reviewed for relevancy. Two observational studies were found and reviewed. Both studies showed a decreased incidence in diabetes mellitus diagnosis in fasting groups compared to non-fasting groups. The quality of the studies was very low warranting further study and higher quality research.

Conclusion: Current research on using routine periodic fasting as a way to prevent or even modulate the disease course of type 2 diabetes is still limited but what research has been done shows that it could have some benefit as an adjunct to a normal healthy diet. It has the added benefit of being a no cost therapy to both the patient and the health care system and if proven to prevent diabetes.

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Master of Science in Physician Assistant Studies

Keywords
Intermittent fasting, type 2 diabetes mellitus

Subject Categories
Medicine and Health Sciences

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The Use of Routine Periodic Fasting to Lower the Incidence of Type 2 Diabetes Mellitus

Matthew Croppi and Patrick Tutt

Clinical Graduate Project Submitted to the Faculty of the School of Physician Assistant Studies
Pacific University
Hillsboro, OR
For the Masters of Science Degree, August 2017

Faculty Advisor: Mark Pedemonte, M.D. & Jennifer Campbell, PA-C, MS
Clinical Graduate Project Coordinator: Annjanette Sommers, PA-C, MS
Biography

[Redacted for privacy]
Abstract

Background: Diabetes mellitus is one of the most common chronic diseases in America and is associated with a number of severe complications including kidney failure, worsening of arteriosclerosis, an increased risk of heart attack and stroke, and loss of vision. The clinical course of diabetes supports the principle that once a patient is diagnosed with type 2 diabetes mellitus there is very little that can be done to reverse the disease process. This knowledge should put prevention of type 2 diabetes not only on the forefront of clinical practice but also of research. One such method of prevention currently being studied is routine periodic fasting. This review addresses the research associated with incidence of diabetes in populations that routinely fast.

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Keywords: Intermittent fasting, and type 2 diabetes mellitus
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List of Abbreviations

DM  Diabetes Mellitus
CAD  Coronary Artery Disease
The Use of Routine Periodic Fasting to Lower the Incidence of Type 2 Diabetes Mellitus

BACKGROUND

Diabetes mellitus is one of the most common chronic diseases in America and is associated with a number of severe complications including kidney failure, worsening of arteriosclerosis, an increased risk of heart attack and stroke, and loss of vision. From 1980 through 2014, the number of Americans with diagnosed diabetes has increased fourfold (from 5.5 to 22 million), and it remains the second leading cause of hospitalizations in American adults accounting for 11 percent of discharge diagnoses. Additionally, the high cost of treating patients with diabetes is taxing on an already overstretched health care system. Average medical expenses are more than twice as high for a person with diabetes as they are for a person without diabetes.

In 2007, the estimated cost of diabetes in the United States was $174 billion. That amount included $116 billion in direct medical care costs and $58 billion in indirect costs (from disability, productivity loss, and premature death). Beyond the monetary costs of treating diabetes, the medications used by diabetics can themselves be inherently dangerous. The use of both insulin and insulin secretagogues can lead to incidences of severe hypoglycemia. These events of severe hypoglycemia can be debilitating to
the patient and around 25% of all episodes of severe hypoglycemia result in coma. Moreover, type 2 diabetes is a disease process associated with a number of comorbidities, such as hypertension, dyslipidemias, stroke, retinopathies, chronic kidney disease, and atherosclerosis. Of note, by 2050 it is predicted that 33% of the people in the United States will have these additional problems.

Much of what is known about the clinical course of diabetes supports the principle that once a patient is diagnosed with type 2 diabetes mellitus there is very little that can be done to reverse the disease process. This knowledge should put prevention of type 2 diabetes not only on the forefront of clinical practice but also of research. One such method of prevention currently being studied is routine periodic fasting. Fasting is commonly defined as an abstinence of food, drink, or both for a defined period of time. This amount of time is outlined differently depending on religious or spiritual practice. Routine periodic fasting has for centuries been an integral part of many religious practices and is now gaining audiences in secular society as a means to improve health. Of even more import is that routine periodic fasting has been associated with an improvement of diabetes-related biomarkers.

Routine periodic fasting could have a large impact on the medical community as a tool to prevent type 2 diabetes. It provides practitioners
with a “no cost” approach in which to help patients avoid one of the most common chronic diseases affecting our nation. In this paper, the possibility of using routine periodic fasting to prevent type 2 diabetes is explored and it is shown how further research on the topic could benefit clinicians serving patients.

**METHODS**

An exhaustive literature search using MEDLINE-Ovid, MEDLINE-PubMed, CINAHL, and Web of Science was conducted. The following search terms were used: intermittent fasting, alternate day fasting, routine periodic fasting, intermittent energy deprivation, calorie restriction, diabetes, prediabetes, prediabetic state, type 2 diabetes, and diabetes mellitus. Bibliographies from relevant articles were also reviewed for additional studies. Studies included were those in which patients adhered to a periodic fasting diet in comparison to a population that did not adhere to a fasting diet and evaluated for the incidence of a diabetes diagnosis. Additional inclusion criteria required human studies and studies published in English. Studies that did not included diagnoses of diabetes mellitus were excluded. The quality of the relevant articles was evaluated used the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group guideline.8
**RESULTS**

The initial search yielded 76 articles for review. After eliminating duplicate articles and applying inclusion and exclusion criteria, 2 articles remained (see Table 1). Both articles were observational studies⁹,¹⁰ and results are shown in Table 2.

The first study reviewed: “Usefulness of routine periodic fasting to lower risk of coronary artery disease in patients undergoing coronary angiography” by Horne et al, published in 2008 was an observational study that looked for an association of routine periodic fasting and the risk of coronary artery disease (CAD). The authors evaluated two populations from Utah undergoing coronary angiography that were in enrolled in the Intermountain Heart Collaborative Study registry. In the population of interest, the sample size was 448. Patients were surveyed for adherence to routine fasting and put into fasting and non-fasting groups. The authors performed exploratory subgroup analyses after evaluating the primary outcome of CAD risk and found that there was a statistically significant difference in the incidence of diabetes between the fasting and non-fasting groups.⁹

Horne et al (2008)⁹ determined the incidence of diabetes through health histories obtained from physicians and hospital records. In the population of interest, the non-fasting group was shown to have an
incidence of diabetes of 20% compared to the fasting group, which had an incidence of 12% with a p-value of 0.048. No confidence intervals for this data were reported in this study. The authors recognized and suggest the association should be investigated further.

The second study: “Relation of routine, periodic fasting to risk of diabetes mellitus, and coronary artery disease in patients undergoing coronary angiography” by Horne et al, published in 2012 was an observational study that was designed to further explore the association of lower diabetes risk found in the first study. A new population of 200 patients was selected and surveyed for adherence to routine fasting behavior in addition to other lifestyle factors. The study defined fasting as “routine abstention from food and drink for extended periods.” Participants enrolled in the Intermountain Heart Collaborative Study registry in Utah undergoing coronary angiography. The patients were placed into fasting and non-fasting groups. The primary outcome of the study was to determine the incidence of diabetes mellitus diagnosis in the two groups.10

Diabetes diagnosis was determined by physician reporting of current medical history or laboratory findings of a 12-hour fasting blood glucose level of ≥126 mg/dl. This study found that the non-fasting group had an incidence of DM of 22.0% while the fasting group had an incidence of 10.3% with a 95% CI of 0.17-0.99 and a p-value of 0.042.10
DISCUSSION

As the rates of patients diagnosed with diabetes mellitus continues to climb, not just within the United States but globally, it becomes increasingly important to find ways to reduce the development of this disease. Even more disheartening is the fact that the rate of diagnosed diabetes mellitus is skyrocketing in American children. Recent data by the Centers for Disease Control and Prevention shows that in the United States about 208,000 people younger than 20 years have diabetes (type 1 or type 2). This represents 0.25% of all people in this age group, or about 1 in 400. If this rate continues it is estimated that by 2050 as many as 1 in 3 American adults will have diabetes. That is a staggering prediction.

The general consensus of these two small studies is that routine periodic fasting does have an effect on the incidence rates of diabetes mellitus. When looking at the rates of diabetes in those that subscribe to routine periodic fasting compared to those that do not, it shows that the rate of diabetes is almost double that in the non-fasting group (table 2). That is equally, if not more staggering, than the predicted incidence rate of diabetes in 2050. Something as simple and cost effective as asking patients to add routine periodic fasting to a healthy diet could cut rates of diabetes in half and in turn have a broader effect on hypertension, dyslipidemia, stroke, kidney failure, retinopathy, and amputations. It would be advisable to
breach the subject of routine periodic fasting with patients with family history of diabetes or those diagnosed as pre-diabetic. The studies show that this can possibly prevent 1 for every 9-13 people from developing diabetes by incorporating routine periodic fasting into their lifestyle (table 2).

Although this paper only addresses the research associated with incidence of diabetes it is important to note that other studies have shown that intermittent fasting has led to a decrease in body mass index, visceral fat, fasting blood glucose levels, fasting insulin levels, and an increase in insulin sensitivity.¹²

Of course, it is important to note that both studies⁹¹⁰ were observational and that there were some very serious limitations noted. There was a failure to differentiate between diabetes type 1 and type 2 in regards to the reported incidence rate. It was also noted the inclusion criteria for the studies involved only those individuals who identified as being religious and that furthermore the fasting subgroup were those individuals who identified as being members of the Church of Jesus Christ of Latter-Day Saints. Members of this religion often abstain from alcohol and tobacco and as such may be inherently healthier than the general population. It is also of note that the Horne et al (2008) study⁹ was originally looking at routine periodic fasting in regards to coronary artery disease and that its effect on diabetes was a secondary outcome found through exploratory subgroup
analyses. Lastly, the Horne et al (2012) study\textsuperscript{10} showed wide confidence intervals both pre- and post- secondary analysis and stated confidence intervals fell close to the number 1. This would suggest that the sample size needs to be broadened which could be accomplished through more rigorous and larger studies.

Even with the limitations listed above it is important that further studies be done in regards to routine periodic fasting. The results of the two studies\textsuperscript{9,10} (Table 2) shows that there is promise in the use of routine periodic fasting as a possible prevention method for diabetes. These results should prompt further research that are more rigorous and that have fewer limitations. There is cause for a large study to follow the positive results shown by the Horne et al studies. Ideally these studies would track long term effects of routine periodic fasting on borderline type 2 diabetics progression or lack thereof into clinical type 2 diabetes.

**CONCLUSION**

Current research on using routine periodic fasting as a way to prevent or even modulate the disease course of type 2 diabetes is still limited but what research has been done shows that it could have some benefit as an adjunct to a normal healthy diet. Many patients currently are looking for more ways that they can take an active part in their own health
maintenance. Routine periodic fasting could soon be one of those tools that clinicians offer to patients as a way to prevent the development of type 2 diabetes. It has the added benefit of being a no cost therapy to both the patient and the health care system and if proven to prevent diabetes could save patients from unneeded harm caused by current diabetic therapies.

Further clinical trials are needed to explore the effect that routine periodic fasting can have on the development and prevention of type 2 diabetes. Much of the current research has been focused on biomarkers associated with diabetes such as body mass index, visceral fat, fasting blood glucose levels, fasting insulin levels, and insulin sensitivity but longer term studies are needed to show the true potential of routine periodic fasting as a preventative measure.
References

1. CDC. Number of persons - diagnosed diabetes - data & trends - diabetes DDT.

2. CDC. Adults - causes of hospitalization - data & trends - diabetes DDT. 


### Table 1: Quality Assessment of Reviewed Articles

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Limitations</th>
<th>Indirectness</th>
<th>Inconsistency</th>
<th>Imprecision</th>
<th>Publication bias</th>
<th>Upgrade Criteria</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horne et al (2008)⁹</td>
<td>Observational</td>
<td>Very serious&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
<td>Not Serious</td>
<td>Not Serious</td>
<td>Very Serious&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Unlikely</td>
<td>None</td>
<td>Very low</td>
</tr>
<tr>
<td>Horne et al (2012)&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Observational</td>
<td>Very serious&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>Not Serious</td>
<td>Not Serious</td>
<td>Serious&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Unlikely</td>
<td>Large magnitude of effect</td>
<td>Very low</td>
</tr>
</tbody>
</table>

<sup>a</sup>Failure to differentiate Type I from Type II DM  
<sup>b</sup>Inclusion criteria biased towards healthier study population  
<sup>c</sup>Incidence of type 2 diabetes was not the primary outcome  
<sup>d</sup>No confidence interval provided  
<sup>e</sup>Wide confidence intervals, CI close to 1

### Table 2: Summary of Findings

<table>
<thead>
<tr>
<th>Study</th>
<th>Diabetes Incidence</th>
<th>P-value</th>
<th>Risk Ratio</th>
<th>Relative Risk Reduction</th>
<th>Number Needed to Treat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-Fasting</td>
<td>Fasting</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Horne et al 2008&lt;sup&gt;9&lt;/sup&gt;</td>
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<td>38%</td>
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<tr>
<td>Horne et al 2012&lt;sup&gt;10&lt;/sup&gt;</td>
<td>22%</td>
<td>10.3%</td>
<td>0.042</td>
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<td>53%</td>
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