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Herbal fertility treatments used in North America from colonial times to 1900, and their potential for improving the success rate of assisted reproductive technology

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Abstract This paper serves to fill a gap in the literature regarding evidence for the use of botanical remedies in the promotion of fertility. It examines the botanical remedies that were used in North America (1492–1900) for all stages of reproduction from preconception to birth, and discusses their potential for future use with present-day infertility treatments. Each medicinal plant discussed in this paper is assessed using an ethnomedicinal methodology that entails examining the published ethnobotanical, phytochemical and pharmacological data. A few clinical trials have shown that there is potential for medicinal plants to improve the success rate of assisted reproductive technology (ART) treatment if used in an integrated manner, similar to the integrated use of traditional Chinese medicine with ART treatment. For example, research has shown that older women who become pregnant have a high miscarriage rate, and this is one area that complementary and alternative medicines can address.

KEYWORDS: botanicals, herbal medicine, infertility, North America

Introduction

In pre-20th century America, women relied on midwives, neighbours and homemade botanical remedies to support their reproductive health Drinker, 1991; England and Kramer, 1922; Leavitt, 1986; Tannenbaum, 2002). (Allopathic medical knowledge of the time was suspect and expensive, and only used when traditional medicines failed (Frader and Stage, 1982; Ray, 2009). Dangerous substances like mercury were used, and doctors believed in harmful practices, such as

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bleeding, vomiting, blistering, purging, anondynes and so forth (Abrams, 2013; Douglass, 1854; Duffy, 1993; Haller, 1981; Ray, 2009).

There are several medicinal plants that could be used in combination with assisted reproductive technology (ART) to lower the cost and increase the success rate of infertility treatment (Kooreman and Baars, 2012). Using herbs in this way is not a new idea. As infertility treatment is expensive and has a low success rate – approaching 49% with cumulative attempts (Vrtacnik et al., 2014) – some women use medicinal plants to try to improve their odds of success without telling their doctor (Broussard et al., 2010). Vitex was used by one woman who was undergoing in-vitro fertilization (IVF) treatment, and she showed signs of mild ovarian hyperstimulation (Cahill et al., 1994). Pregnant women use medicinal plants to give them greater control over their experience, and this control improves birth satisfaction (Clark et al., 2013; Hall et al., 2012; Shannon et al., 2010; Smith et al., 2010; Westfall, 2001; Zeyneloglu and Onalan, 2014). There are case reports of women who have become pregnant following alternative treatments. A 38-year-old Caucasian woman gave birth after being treated with Ayurvedic medicine in a German clinic. The treatment included some of the plants discussed later in this paper. The patient had secondary infertility of unknown cause, and had previously had 18 conventional fertility treatments in five different fertility centres in three different countries (Kessler et al., 2015). However, most fertility specialists do not know or ask what plants their patients are using (Shannon et al., 2010; Zeyneloglu and Onalan, 2014), and the testing of plant therapies in controlled trials is rare. However, there are some initial steps being taken towards an integrated approach in some clinics and in clinical trials. For example, Shahin et al. used black cohosh in combination with clomiphene citrate, and reported an increased clinical pregnancy rate for women under 35 years of age (Shahin and Mohammed, 2014; Shahin et al., 2008, 2009). These clinical trials are discussed later in the paper.

The argument put forward in this paper is two-pronged: (i) women are already using traditional botanical remedies, with or without the consent or knowledge of their doctors (Anon, 2014; Hall et al., 2012; Shannon et al., 2010; Smith et al., 2010) – this paper examines the published phytochemical and pharmacological data on the plants that are being used to assess their safety and efficacy; and (ii) there are potential benefits to examining plants that have been used for centuries by Native Americans, or that came to America through European immigration, or that have a basis in historical Greek or Arabic medical treatises, such as opopanax (*Opopanax chironium*), asafoetida (*Ferula assa-foetida*) and others. There is anecdotal and other evidence that at least some of the biochemically active compounds in the plants that have been used traditionally could serve as adjuncts to fertility treatments, potentially reducing costs by raising efficacy and offering hope and help to women barred from accessing ART treatment due to variable age and cost limits in different countries.

The most promising areas for the use of botanicals in improving livebirth rates are: (i) age-related decreased ovarian reserve (≥40 years of age), (ii) stress associated with subfertility (oxidative stress or linked to increased prolactin levels), (iii) luteal-phase defects, and (iv) increased rate of miscarriage for older women receiving ART because fertility declines with age and the demand for IVF typically increases with age. If herbs can increase the success rate of ART by preventing miscarriages and improving implantation rates, for example, this would lower the cost of ART.

This paper identifies the sources of herbal remedies in North America up to 1900, describes evidence for their effectiveness and any side effects, and examines how the use of plants may help ART.

Materials and methods

An ethnomedicinal validation technique is used in this paper to identify traditional medicines with contemporary value. Validation includes examining the published phytochemical and pharmacological data to establish whether or not the reported folk use of plants is safe and effective (Lans et al., 2003). As this is a search for potential plant compounds to be used in future clinical trials and a historical study, exclusion criteria were not used in the validation process for the literature reviewed in this paper. Many of the books and journals used from 1492 to 1900 have been digitized, and these were searched online for terms related to reproductive problems; the plants used to treat patients with the noted condition were recorded. In most cases, these documents were patient reports, discussions of newly analysed plant compounds, or discussions of new patent medicines based on newly discovered North American plants. The databases used for the validation of the plants were ScienceDirect, PubMed and Scopus. The databases JSTOR and ProjectMUSE were also searched, but yielded little information.

The dates for the time periods relevant to this paper are listed by the Gilder Lehrman Institute of American History (https://www.gilderlehrman.org/history-by-era/early-republic/essays/early-republic), as follows:

- Colonial Period, 1585–1763: colonists brought their herbals to America, *Poor Richard's Almanac* first printed.
- Revolutionary Era, 1764–1783: the first home health books were printed, and the first sales of Lydia Pinkham's formula took place.
- Early Republic, 1783–1815: midwives like Martha Ballard kept diaries, the Bartrams' work entered the botanical literature.
- National Expansion and Reform, 1815–1860: scientific publications on American plants increase.
- Civil War and Reconstruction, 1861–1877: *The Lancet* published a discussion of Lydia Pinkham's formula (see below).
- Rise of Industrial America, 1877–1900: more plant uses based on Native American traditions enter the *United States Pharmacopoeia*.

A key to apothecary measurements used in dosages is given in Supplementary Material Item 32.

Women's use of herbal medicine in colonial America and their sources of information

The knowledge of colonial Americans has been documented for well-known colonists and by women whose diaries have

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