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Case Series

Spontaneous Pregnancies in Polycystic Ovary Syndrome (PCOS) Patients with a Low Starch/ Low Dairy Diet: A Retrospective Case Series

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Abstract

Background/Objective: A low starch/low dairy diet resulted in spontaneous conceptions in ten obese infertile women with Polycystic Ovary Syndrome (PCOS). **Case Report:** Through a retrospective chart review of a fertility clinic, ten obese infertile women with PCOS conceived spontaneously after switching to a low starch/low dairy diet. Spontaneous conceptions occurred without medications (no metformin, weight loss drugs or ovulation inducing medications), exercise or caloric/fat/carbohydrate restrictions. The nutritional guide encouraged unlimited consumption of lean meats, non-starchy fruits and non-starchy vegetables. Nuts and seeds were permitted for snacking as well as one ounce of full fat cheese daily. The group had an average BMI reduction of 2.6 points. All pregnancies were singleton gestations. **Discussion:** Variable presentations of PCOS symptoms and metabolic inflexibility have made finding an ideal dietary recommendation challenging for PCOS patients and for their health care providers. A low starch/low dairy diet may improve spontaneous ovulation and possible conception in obese infertile women with PCOS. Nutrition appears to play a pivotal role in improving ovulatory function and fertility potential in obese women with PCOS. **Conclusion:** Dietary intervention may be a simple and highly effective treatment for the metabolic and reproductive problems caused by PCOS. A low starch/low dairy nutritional plan may give clinicians an easily accessible and sustainable tool for treating obese PCOS patients who desire conception.

Keywords: PCOS; Infertility; Obesity; Nutrition

Introduction

Polycystic Ovary Syndrome (PCOS) was first described in 1935 by two gynecologists, Drs. Irving F. Stein and Michael L. Leventhal, who recognized a pattern of menstrual cycle irregularity, male-pattern hair growth and enlarged, polycystic appearance of ovaries in some women [1]. Despite an estimated prevalence of 10% in the general female population, PCOS has no universally accepted treatment. Off-label use of medications and conflicting dietary recommendations present a challenge for health care providers and for their patients struggling with PCOS [2]. In 2013, the United States National Institutes of Health (NIH) diagnostic criteria for PCOS were modified and currently require 2 out of 3 of the following: oligomenorrhea (menses >35 days apart), higher male-type hormones (by elevated serum androgens or by clinical findings of male pattern hair growth, cystic acne or scalp hair thinning) and the presence of a polycystic ovary [3]. Women with PCOS have a 5- to 10-fold greater risk of developing type 2 diabetes with half being diagnosed with diabetes before age 40 [4]. PCOS has also been shown to increase the incidence of heart disease, metabolic syndrome, depression, uterine cancer and infertility.

Case

This retrospective case series describes ten women with PCOS who spontaneously conceived while following a low-starch/low-dairy diet. Ten women seeking fertility treatment from a reproductive endocrinology and infertility clinic were confirmed to have PCOS consistent with NIH 2013 diagnostic criteria. Diagnosis of PCOS was based on oligo- and/or amenorrhea and the presence of hyperandrogenism (clinical and/or biochemical). All participants had at least one polycystic ovary by transvaginal ultrasound. Oligomenorrhea was determined by cycle length (>35 days) [3].

Subjects received written instructions for a low-starch/low-dairy diet, which has demonstrated successful weight loss, improved insulin sensitivity, improved vitamin D concentrations and lower testosterone and triglycerides [5]. Participants were encouraged to eat all of the following at each meal until they were satisfied with snacks between meals and at bedtime: lean animal protein (meat and poultry), fish and shellfish, eggs, non-starchy vegetables, low sugar fruits (berries, apples, oranges, plums, etc.), avocado, olives, nuts and seeds, and oils (olive and coconut). Subjects, who were all older than 21 years, were allowed 6 ounces of red wine per day, and all subjects were allowed 1 ounce of chocolate with >75% cocoa and 1 ounce of full-fat cheese per day. Previous studies have shown cheese, which is mostly casein rather than whey, to be less insulinemic than other dairy products. Therefore, cheese was allowed in restricted amounts to aid in dietary compliance.

The diet excluded all grains, beans, other dairy products, and sugar (including fruit juice from concentrate, raw turbinado sugar, evaporated cane juice, high-fructose corn syrup, honey, or agave nectar) because of their insulinemic properties. Non-nutritive sugar substitutes were allowed for participants who wished to use them. While green vegetables, nuts, and seeds are good sources of calcium, additional calcium-fortified non-dairy alternatives (unsweetened almond, coconut or soymilk) were allowed for participants that wished to supplement their calcium intake. Participants were advised not to count calories, carbohydrates, or fats and were encouraged to eat until they were satisfied but not to overeat. Table 1 shows the ages, changes in BMI after starting the diet, and number of days after starting the diet at which each patient had a documented positive pregnancy test.

Age	# of Days until documented Positive Pregnancy	Pre-Diet BMI	Change in BMI
25	159	33.7	-2.61
32	103	43.1	-3.62
29	7	33.28	0
35	48	31.1	-2.7
28	120	36.7	-8.33
26	74	32.1	-2.5
28	33	31.31	-1.25
25	183	39.36	0.18
30	70	45.2	-4
27	63	38.2	-1.5

Table 1: Age, change in BMI, and number of days after starting the diet at which each patient became pregnant.

The ten patients outlined in Table 1 ranged in age from 25 to 35 years and achieved spontaneous ovulation and pregnancy in an average of 86 days after modifying their nutrition. Initial BMI ranged from 31 to 45. The ten patients showed successful weight loss, reducing their BMI by an average of 2.6 points.

Discussion

Obesity and PCOS share many of the same underlying endocrine-based pathologies. Adipose tissue impacts nearly every hypothalamic/pituitary feedback cycle through various signaling molecules. One of the most well documented mechanisms is the role of hyperinsulinemia in both androgen production and androgen regulation. Insulin has been shown to increase androgen production via stimulation of P450c17 activity in ovarian theca cells and to decrease Sex Hormone Binding Globulin (SHBG) production in the liver, thus raising the bioavailability of androgens in peripheral tissue [6]. Peripheral tissues downregulate insulin receptors in response to increased androgens, leading to further increased insulin production by the liver. Paradoxically, this insulin resistance in metabolic tissues does not translate to its mitogenic properties as an MAPK signaling peptide in gonadal tissues, as illustrated by differences in insulin actions in granulosa-lutein cells obtained from women with anovulation with PCOS [7]. Specifically, insulin-stimulated glucose uptake is impaired, whereas insulin-stimulated progesterone production is preserved. This creates a positive feedback loop where metabolic disorders and hyperandrogenic states in PCOS can act synergistically to exacerbate the clinical symptoms associated with both pathologies. Therefore, any therapy that is offered for PCOS should not only address the dysregulation of the GnRH axis but also the metabolic axis's role in creating the hyperandrogenic state.

The interest for this case series arose when patients who were participating in an 8-week dietary intervention had spontaneous conceptions after years of infertility. Many had never menstruated without oral contraceptive pills or progesterone to induce a withdrawal bleed, yet they spontaneously conceived after simply changing what they were eating, not how much they were eating.

The mechanism of action for the low starch/low dairy diet is being investigated. It appears to normalize hormonal signaling by lowering insulin and androgens to allow spontaneous ovulation. Research shows that carbohydrates from dairy and starch-based foods have greater insulin-producing properties than carbohydrates from non-starchy vegetables and fruits [8]. And as stated earlier, dysregulation of insulin signaling can work synergistically with hyperandrogenemic states to offset estrogen regulation.

Chavarro, et al. identified that an increased adherence to the "fertility diet", which decreased intake of trans fat and animal protein, increased intake of high-fiber, low-glycemic

carbohydrates, and increased preference for high-fat dairy and multivitamin intake, was linked to a significantly decreased risk of infertility [9]. Consumption of low-glycemic carbohydrates and their connection to improved ovulatory function echoes findings from this low-starch diet and elucidates the role of insulin resistance in infertility. Regarding exclusion of dairy intake in the diet used for this study vs. the "fertility diet", despite falling on the low end of the glycemic index, high intake of low-fat dairy products has been shown to induce insulin resistance and anovulatory infertility in women [10,11]. This effect is probably due to the nature of its high disaccharide content and is the reason participants were instructed to avoid most dairy.

Additionally, dietary changes can directly change gut microbiome composition, which can itself have an indirect effect on both insulin sensitivity and androgen regulation. Also, intestinal colonies of E.coli and other species have been shown to decouple estrogen-SHBG secreted in bile acids via secretion of B-glucuronidase, leading to luminal reabsorption of androgens. This phenomenon gives the intestinal microbiome a direct role in androgen regulation [12]. Dietary modulation of starch and dairy could play a role in gut microbiome composition, which can directly contribute to chronic inflammation, obesity and insulin resistance [13]. Additional research will determine which of these effects, if any, provides a explanation of therapeutic effects and improved fertility.

Regardless of the mechanism of action, the current observed efficacy of this diet shows promise. With an average reduction in BMI of 2.6 along with an average conception time of 86 days, the low starch/low dairy diet's clinical application rivals current practices such as combined metformin–clomiphene citrate therapy, exercise or caloric restriction alone. These outcomes demonstrate that dietary modification can be a potential tool for clinicians who treat infertile women with PCOS and is a great first step in helping these patients achieve their goals of health improvement, weight loss and pregnancy.

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