# Diet, Energy, and Hormone Regulation

by

**E. Jeannette Santino**

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# Diet, Energy and Hormone Regulation

By

Elaine Jeannette Santino, MS

Statistical Analysis by: Dr. Kim Kelly, ND

Clayton College of Natural Health

Birmingham, Alabama

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# ABSTRACT

Past studies have been done on the effects specific foods have on the adrenal glands and other hormones. This study is concerned with the combined effect that a well-rounded, healthy, nutrient-dense food program while eliminating the use of selected substances known to alter hormones, such as alcohol, caffeine, soy, hormone-laced meat, common allergy foods, would have on the adrenal glands and specific hormones.

The investigator studied six individuals that had never been on hormone replacement therapy and were on a less than optimal diet. One post-menopausal woman, four menstruating women, and one male volunteered to be test subjects. A salivary assay baseline was taken of the hormones: cortisol, dehydroepiandrosterone sulfate (DHEA-S), testosterone, progesterone, and estradiol before they began the eight-week dietary change. Participants were given a list of approved foods and a list of foods forbidden during the eight-week program. They kept a detailed list of foods they consumed on a daily basis during the eight-week program as well as the week prior to the study when they consumed their usual foods. They reported in a detailed journal any changes in their energy, sex drive, bowel habits, and mood changes. At the end of eight weeks, the same salivary assay was taken of the five hormones and the pre and post lab reports were evaluated.

There was an increase in testosterone for five of the subjects and a slight decrease in the one test subject that was not 100% compliant. The male test subject was the only one that noted a substantial increase in sex drive in his journal. Even though four of the women test participants also had a rise in testosterone levels, they did not note an increase in their libido. Fifty percent showed a healthy increase in 8:00 a.m. cortisol. Four

test participants began with erratic circadian cortisol rhythms. Of those four, three showed a return to normal circadian rhythms on the post-test. With respect to weight and body mass index (BMI), 100% lost weight and had a drop in BMI. There was no significant shift in DHEA-S, progesterone and estradiol in all six of the test participants.

Although the study period was short and there were only six participants, there was an improvement in adrenal function, an increase in testosterone, and a positive shift in weight and body mass index. A healthy well-rounded nutrient-dense food program can have a positive effect on the adrenal glands and the hormones they produce. Further investigation needs to be done in this area to see the effects a nutrient-dense diet would have on adrenal function and hormone production over a longer period of time and with a larger participant base.

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I wish to acknowledge my husband Mike, who has enthusiastically and lovingly given me his encouragement and support through the process of my education, research and writing. Also my son, Jared, that has helped fuel a desire to find natural solutions to complex health issues, and ways to build and maintain a healthy body throughout the years.

I greatly appreciate the research study volunteers that willingly went through pre- and post-laboratory tests, changed their dietary habits, kept detailed journals, met with me weekly, and cooperated in the research program for the nine weeks of research. They were all very supportive, and displayed a positive attitude.

What has also continued to feed my thirst for knowledge in preventative and holistic health these past 25 years has been the love of my father who died in 1980. Being greatly discouraged by the way traditional medical doctors handled his illness, I vowed to learn how to achieve and maintain vibrant health, naturally.

I am also very grateful for the patience and guidance of my faculty advisor, Janice Martin, and others at Clayton College of Natural Health, and for Dr. Kim Kelly, ND who helped in the statistical analysis of the data collected on the research subjects.

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# LIST OF ABBREVIATIONS

ADAM – Androgen Deficiency in the Aging Male

Ca – Calcium

Cl – Chloride

CLIA – Clinical Laboratory Improvement Amendments

DHEA – Dehydroepiandrosterone

DHEA-S – Dehydroepiandrosterone Sulfate

DIANA Study – Diet and Androgens Research Study

HRT – Hormone Replacement Therapy

K – Potassium

Mg – Magnesium

Na – Sodium

P – Phosphorus

PADAM – Partial Androgen Deficiency in the Aging Male

SHBG – Sex Hormone Binding Globulin

WHI – The Women's Health Initiative

O-DMA – O-desmethylangolensin

WHIMS – Women’s Health Initiative Memory Study

# DEFINITION OF TERMS

Adrenocortical – Pertaining to the adrenal cortex. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Amenorrheic, amenorrhea – Absence of menstruation in women who had previously experienced menstruation and are not pregnant. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Androgen – A substance producing or stimulating the development of male characteristics. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Andropause – A variable complex of symptoms, including a decline in androgen production, occurring in men after middle age, purported to be analogous to menopause in women. (Dorland's Medical Dictionary)

Androstenedione – Hormone, a precursor of testosterone. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Anovulatory – Without ovulation. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Aromatase – An enzyme activity catalyzing the conversion of testosterone to the aromatic compound estradiol. *(Dorland's Medical Dictionary)*

Conjugated – Paired or joined. Conjugated estrogen is estrone and equilin combined to treat menopausal symptoms. Trade name is Premarin. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Cortisol – A glucocortical hormone of the adrenal cortex. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Dehydroepiandrosterone (DHEA) – The most abundant androgen (male steroid hormone) secreted by the adrenal glands. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Dehydroepiandrosterone sulfate (DHEAS) – The sulfated version of DHEA. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Dysmenorrhea – Painful menstrual cramps. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Endogenous – Substances are those that originate from within an organism. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Estradiol – A steroid produced by the ovary and possessing estrogenic properties. Estradiol is the most potent estrogen of a group of endogenous estrogen steroids that includes estrone and estriol. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Homeostasis – The state of dynamic equilibrium of the internal environment of the body that is maintained by the ever-changing processes of feedback and regulation in response to external or internal changes. *(Taber's Cyclopedic Medical Dictionary, Edition 19)*

Hydrolysis – A chemical decomposition in which a substance is split into simpler compounds by the addition or the taking up of the elements of water. *(Taber's Cyclopedic Medical Dictionary, Edition 19)*

Isoflavones – A relatively weak estrogen-like compound. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Lignans – A steroid-like chemical found in flaxseed and related plants that may be beneficial in the management of hormone sensitive illnesses. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Medroxyprogesterone acetate – A progestational agent used to treat hormone imbalance or contraception. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Menopause – Permanent cessation of menstrual activity for a period of at least 12 months. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Neuroendocrine – Pertaining to the nervous and endocrine systems as an integrated functioning mechanism. *(Taber's Cyclopedic Medical Dictionary, Edition 19)*

Phytoestrogens – Estrogen-like steroid compound found in beans, sprouts, fruits, vegetables, cereals and some nuts. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Pregnenolone – A steroid hormone involved in the steroidogenesis of progesterone, mineralocorticoids, glucocorticoids, androgens, and estrogens. As such it is a prohormone. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Premenopausal or Perimenopausal – The phase prior to the onset of menopause where menstrual cycle begins to change and other hormonal symptoms develop, also characterized by 3 to 11 months of amenorrhea. While menopause has a clear and accepted definition, perimenopause does not. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Progesterone – A steroid hormone obtained from the corpus luteum and placenta. *(Taber's Cyclopedic Medical Dictionary, Edition 19)*

Prohormone – Precursor of a hormone. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Psychoneuroendocrinology – The clinical study of hormone fluctuations and their relationship to human behavior and psychiatric illness. It is the blend of endocrinology and psychiatry. *(http://www.psychoneuroendocrinology.com/)*

Testosterone – A steroid hormone from the androgen group. Testosterone is primarily secreted in the testes of males and the ovaries of females although small amounts are secreted by the adrenal glands. It is the principal male sex hormone and an anabolic steroid. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Vasomotor – Relating to the nerves and muscles that cause the blood vessels to constrict or dilate. (*Taber's Cyclopedic Medical Dictionary, Edition 19)*

Vivo – *In vivo* is used to indicate in the living body or organism *(Taber's Cyclopedic Medical Dictionary, Edition 19)*

Well-being – A state of mental and physical balance and fitness. *(Writers personal definition.)*

Xenobiotics – Chemical substances that are foreign to the biological system. *(http://medical.webends.com/kw/Xenobiotics)*

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# CHAPTER ONE: INTRODUCTION TO THE PROBLEM

## Statement of the Problem

Interest in anti-aging in America today has lead many to begin using a variety of hormonal supplements. For some it is for the purpose of slowing the aging process, for others it is for abating the uncomfortable symptoms of menopause or male andropause. Currently synthetic hormone replacement therapy and natural hormone replacement therapy are the two most used means of balancing hormones in the traditional medical model. Any hormone, natural or synthetic, has the potential for abuse and can cause unwanted side effects, especially if a trained practitioner does not monitor the person regularly. However, correcting any hormone imbalance is, in most cases, not just simply a matter of supplying the body with hormones.

The long-term risks of traditional hormone therapy indicate that it might be better to supply nutrients that may aid individuals to produce hormones on their own. Perhaps the optimal strategy is to instruct both men and women on how to eat and live in such a way as to prevent hormone insufficiency in the first place. If it could be ascertained that proper diet and stress management could prevent hormone loss and/or rebuild depleted hormone levels, people may be encouraged to be more conscious of what they eat and of their over all lifestyle at an earlier age so as to prevent hormone depletion. Perhaps too, more health professionals would make nutritional counseling a regular part of their clinical practice.

For many years the hormone supplement of choice in traditional medicine for women with hormonal issues is Premarin. The *Journal of the American Medical*

*Association*, in July 2002, published the results of the first large randomized, placebo-controlled trial of conjugated equine estrogen plus medroxyprogesterone acetate in healthy women. This study, known as The Women's Health Initiative (WHI) trial identified an increased risk of heart attacks, strokes and deep venous thrombosis, prompting premature closure of the study (Grady et al., 2002; Hulley et al., 2002). As with most pharmaceutical drugs, while there may be some benefit, there are often risky side effects.

The investigator of this current study on diet, hormones and energy regulation sought to determine if the body's natural ability to produce the necessary amounts of hormones for good physical and emotional health could be restored or aided by the use of nutrient-dense foods under reduced stressed conditions. An important aspect of this study is also to stop feeding the body substances that will deplete the body’s reserves of these hormones. Therefore, this study is not about how the body responds when given an isolated nutrient or hormone; neither is it about a drug given to suppress a symptom, but rather preventing a problem or possibly reversing the imbalance with essential nutrients alone. The results of this study can be used to assess the need for nutritional counseling as a standard practice in any health care modality.

## Background and History of HRT

Hormone replacement therapy (HRT) has been the mainstay of allopathic medicine for female menopausal and male andropause symptoms. Birth control pills are used for more than the prevention of pregnancy. They are also used in cycling women to regulate their cycles, control acne, reduce heavy bleeding, and as a fix-all for any

menstrual dysfunction. Many medical professionals feel testosterone shots or gels are the answer (Lee, 2003) when men complain of lack of libido, reduced energy, decreased sense of well-being, decrease in muscle mass, erectile dysfunction, and lack of motivation or depression, and serum testosterone levels are sub-optimal.

With recent research findings, women are seeking alternatives that do not carry the risks associated with synthetic HRT. Some, to help with menopausal symptoms uses exercise, relaxation techniques, and dietary changes to incorporate whole foods and soy. Many women have used botanicals such as black cohosh and red clover to decrease the severity and frequency of hot flashes. Because of the controversy and uncertainty about using synthetic hormone replacement therapy, many women request a more holistic approach (Kass-Annese, 2000). Seventy-six percent of women surveyed in one study used alternative therapies; 89 to 100% of these women found alternative therapies to be somewhat or very helpful (Kam, Dennehy & Tsourounis, 2002). An integrative approach to easing the transition into menopause and perhaps slowing down and/or preventing andropause in men would involve the use of diet, exercise, mind-body skills, supplements, and herbs.

## Andropause

The term andropause refers to a physiological state in which the production of androgen hormones, such as testosterone, decline in men. Other terms that have been used to define this are: “androgen deficiency in the aging male (ADAM), partial androgen deficiency in the aging male (PADAM), male climacteric, relative hypogonadism and hypoandrogenemia” (Lee, 2003, p. 23) The level of androgen

production can be the reason why some men will age with vitality, vigor, and virility, and others will not. The identification of andropause is commonly overlooked because there is a slow and gradual drop of testosterone compared to female menopause in which there can be an abrupt drop in estrogen, and immediate symptoms of decreased hormone levels. In addition, many men rarely complain and generally do not seek help, instead they just associate loss of libido, strength and energy as part of the aging process and accept the thought that there is nothing they can do.

A decrease in the androgens in men can be associated with the aging process, or "secondary to environmental factors such as stress, smoking and physical activity" (Vermeulen & Deslypere, 1985, Abstract). It was also noted by Vermeulen and Deslypere (1985) that serum levels of testosterone were more sensitive to stress in younger men, and they noted that diet had no consistent alteration on testosterone levels.

## Research Questions

The present study was guided by the following research questions:

1. Will a healthy, nutrient-dense diet alone aid in hormone production, thereby lessening the need for hormone supplementation?
2. Will a healthy diet aid in hormone regulation by taking stress off the digestive system, which in turn reduces stress on the adrenal glands?
3. Will a nutrient-dense food plan be sufficient or will some individuals need to supplement with natural hormone replacement therapy regardless of a healthy dietary program?

## Purpose of the Study

The general purpose of this study was to determine from salivary tests if the hormones cortisol, DHEA-S, testosterone, progesterone, and estradiol can be brought back into balance by giving the body what it needs on a foundational level without using hormones or supplements of any kind, natural or synthetic. Specifically, the investigator was interested in:

(a) Whether basic natural elements such as amino acids, enzymes, minerals, vitamins, and essential fatty acids from nutrient-dense foods, can aid the body to restore hormones naturally without HRT

(b) Can the adrenals return to a normal circadian rhythm and normal function by strict adherence to a healthy diet and lifestyle

## Significance of the Study

Poor nutrition and stress can deplete the body of its nutrient stores and deprive it of the elements necessary to make hormones. Because hormone deficiency for both genders and all age groups can create other health issues, it behooves health practitioners to find natural alternatives in aiding the body to produce healthy level of hormones throughout the lifespan.

Currently in the United States women with hormone depletion issues are often put on prescription hormone therapy from their physicians. However, as shown by the WHI trial quoted previously, this approach is not without serious consequences. Quality of life is important in all age groups. Keeping hormone levels healthy needs to be something that is addressed nutritionally on a daily basis just as healthy weight, healthy bowel and

urinary functions, and other important physical and mental health concerns are addressed daily.

The study is significant in that many among the population of the United States have adrenal dis-regulation/malfunction along with an imbalance in the sex steroid hormones. Rather than finding a drug that will suppress the symptoms of the dysfunction or do the work for the body, it is this investigator's belief that research also could be done on what types of healthy foods can contribute to restoring homeostasis, along with removing the foods that have been shown to have a negative impact.

## Brief Review of the Endocrine System and Hormone Production

Like all human systems, the endocrine system, its production of over 200 different hormones and their functions, is very complex, and it is not the purpose of this study to delve into this complexity. The following is included to give a very brief overview of the endocrine system and the hormones evaluated in this study.

The endocrine system consists of glands, which secrete messenger molecules called hormones. Each hormone attaches only to specific receptor molecules on the surfaces of certain cells. The hypothalamus, pituitary, pineal, parathyroid, thyroid, thymus, pancreas ovaries, testes, and adrenal glands are the primary glands involved in the production of hormones. Glands within the endocrine system typically interact with one another and control production of hormones. The endocrine gland that secretes a hormone is responding to the need to restore homeostasis.

Hormonal function involves four main areas: (a) reproduction; (b) growth and development; (c) maintenance of the internal environment (homeostasis); and (d)

production, utilization, and storage of energy. Hormones are critical to the maintenance of the internal environment to sustain the structure and function of cells. They regulate the volume and electrolyte content of body fluids, blood pressure, and heart rate; acid-base balance; body temperature; and the mass of bone, muscle, and fat.

In this study, the investigator looks primarily at the hormones: cortisol, DHEA-S, progesterone, estradiol, and testosterone. Primarily the ovaries, testes and adrenal glands as well as peripheral tissues produce these hormones. Both sexes produce all of these hormones, but in varying amounts. Each adrenal gland consists of two functionally distinct endocrine glands within a single capsule, referred to as the cortex and medulla. They are triangular in shape, measure two to three centimeters wide, four to six centimeters long, and about one centimeter thick, each weighing about four grams regardless of age, weight or sex. The adrenal cortex is responsible for production of three major classes of steroid hormones: glucocorticoids, which regulate carbohydrate metabolism; mineralocorticoids, which regulate the body levels of sodium and potassium; and androgens, whose actions are similar to those of steroids produced by the male gonads.

Cholesterol is the starting material for the synthesis of steroid hormones. Adrenal steroids include DHEA and its sulfate, DHEA-S, the most abundant hormones produced by the adrenal glands. DHEA and androstenedione can serve as a basis or foundation for the formation of testosterone in peripheral tissues; synthesis of testosterone in the adrenal glands is minimal. Only small amounts of estrogen are synthesized by the normal adrenal, but DHEA, DHEA-S, and androstenedione are substrates for estrogen production

by peripheral tissues such as adipose tissue, which contain considerable aromatase activity.

Although the testes and the ovaries produce many steroids, the two most important are testosterone and estradiol. The biosynthetic pathway to sex hormones in male and female gonadal tissue includes the production of the androgens: androstenedione and DHEA. Testes and ovaries contain an additional enzyme that enables androgens to be converted to testosterone. DHEA, DHEA-S, androstenedione, and cortisol are the principal adrenal steroids. DHEA is actually known as a prohormone. The adrenals produce more DHEA than cortisol and is present in the blood at concentrations second only to cholesterol. After menopause all estrogens and almost all androgens are made locally in peripheral tissues from DHEA which indirectly exerts effects, among others, on bone formation, fat cells, muscle, insulin and glucose metabolism, skin, libido and well-being.

## Bioidentical Hormones

It is important to differentiate between synthetic hormones, natural hormones, and bioidentical hormones. Synthetic hormones are formulated in a laboratory. Natural hormones come from another animal species, such as Premarin, from pregnant mares' urine. Natural hormones are processed with very few chemical changes and are not chemically identical with those found in humans. Bioidentical hormones are synthesized from plant sources, which are modified chemically to form products that are chemically identical with human hormones. Bioidentical hormones are preferable when hormone replacement is necessary because they are identical to hormones produced by humans.

Integrative health care providers recommend bioidentical hormone replacement when other lifestyle, nutritional, or herbal supplementations are not effective in controlling hot flashes. According to one systematic literature review, black cohosh, exercise, and soy protein have been shown to be safe and effective in short-term use. (Fugate & Church, 2004). However, sometimes the hormone levels are so low, and the adrenal glands are so exhausted that they can no longer produce the hormones required for optimal health. It must be noted that to date, there have not been any long-term trials studying the use of bioidentical hormones for hormone replacement, as there has with the drugs Premarin and Progestin.

## Risks Outweigh Benefit

A 1991 Women's Health Initiative (WHI) study, showed that the combined drugs studied, synthetic hormones Premarin and Progestin, caused increases in breast cancer, heart attacks, strokes and blood clots (Grady et al., 2002; Hulley et al., 2002). The researchers concluded that although the risk to an individual woman may be small, the number of cases occurring in the population at large could be great. The study was halted and the data released four years earlier than expected because of researchers' concerns about the risk to the women studied.

More than 16,600 women in the United States participating in the combined estrogen-progestin portion of the trial were sent letters telling them to discontinue taking those two drugs. The WHI is continuing to study the effects of estrogen replacement therapy, or estrogen-alone drugs, used by women who have had a hysterectomy. As of this date, WHI has not discontinued that portion of the study. Overall health risks for

women taking combined estrogen (Premarin) plus synthetic progestin therapy were found to outweigh any possible benefits. (Grady et al., 2002; Hulley et al., 2002). The trial was stopped because the risk-benefit balance was unfavorable.

An article in the January 26, 2000, *Journal of the American Medical Association* reported that researchers at the National Cancer Institute had found that women who are current or recent users of combined estrogen and progestin had a higher relative risk of breast cancer than women who take only estrogen (Schairer et al., 2000). It is the opinion of this researcher that synthetic hormones should be the last correction of choice when there are safer alternatives.

## Summary

Both menopause in women and andropause in men and the vast amount of symptoms they generate are due to a shift in adrenal and sex steroid hormones. A drop in hormones is normal as we age. It is the extreme drop and the resulting side effects that will cause many women, as well as some men to seek medical intervention. Lives may be healthier if hormones are maintained at healthy levels throughout our lifetime, even with advancing age. Since prescription drugs carry their own level of risk, it is beneficial to investigate the natural alternatives.

# CHAPTER TWO: REVIEW OF RELATED LITERATURE AND RESEARCH

Nutrients, or the lack thereof, have an effect either directly or indirectly on human hormones. In designing this study, the investigator needed to consider several factors with respect to food intake amounts and food choices. This was not a weight loss plan; therefore, the amount of nutrient-dense food was not restricted and the subjects were encouraged to eat healthy foods to satisfaction. Substances such as alcohol, cigarettes, gluten foods (due to possible sensitivities), hormone-laced meat, soy, caffeine, refined carbohydrates, and refined sugar were prohibited during the eight-week study because of and the possible influence they may have on hormones and stress they may place on the digestive tract and ultimately the adrenal glands.

## Literature Review

### Fasting and Low-Energy Diets Affect Hormones

It has been determined in many studies, a few of which are referenced here, that low dietary intakes will have an effect on various hormones. The following studies give indication that fasting or food deprivation will raise cortisol levels, that a low calorie or low energy diet will disrupt the menstrual cycle and decrease steroid sex hormones, and estrogens are reduced with high fiber diets. These studies are mentioned here simply to express that what we ingest can have a positive or negative effect on our hormone production.

- It has been demonstrated that cortisol levels will rise during times of fasting by a study where cortisol was evaluated at four-hour intervals during two 24-hour periods (Fraser et al., 2001). Cortisol was evaluated first while eating a normal