THE AYURVEDA TRIDOSHA CONCEPT AND THE HUMAN APOLIPOPROTEIN E GENOTYPE: A QUANTITATIVE STUDY

by

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Abstract

Ayurveda, the ancient medical system of India, uses the tridosha concept with the goal of disease prevention. Western medicine focuses on providing excellent treatment protocols for disease after it has occurred. The mapping of the human genome as completed and published in 2003 provided the basis for Western medicine’s approach to genetic linking and treatment for specific diseases. The human genotype Apolipoprotein E (Apo E) has been studied and linked to both Alzheimer’s disease and coronary artery disease. The purpose of this study was to investigate whether a statistically significant relationship exists between the Ayurveda tridosha concept of the categories of pitta, vata, and kapha and the human genotype Apo E. The study sample consisted of 319 volunteers aged 18 through 90. Both genders were represented. Participants were selected from more than 2,200 interviews conducted at professional conferences, informational sessions, and doctors’ offices. All participants provided their dosha typing using a standardized dosha questionnaire and their Apo E by providing either a buccal swab saliva sample or Apo E results from their doctor’s office. All dosha types were represented, as were all Apo E alleles. The results demonstrated the distribution of the participants’ Apo E genotypes was largely consistent with the general human population with the exception that e3/e4 was overrepresented by about 52%. Although there was no statistical significance in the relationship between the Ayurveda doshas and the human genetic marker Apo E in this sample, this study opens the door to explore applying traditional Ayurveda practices for disease prevention.
Dedication

Johann Wolfgang von Goethe wrote, “Love does not dominate; it cultivates.”

I dedicate this study to my beloved husband and lifetime partner Charles P. Closshey, who authentically and faithfully provides an environment for me to feel his unconditional love and support. I am profoundly honored by his encouragement and direct cultivation of my aspirations, enabling me to live fully and with wholeness. My deepest love and gratitude to this most honorable man.
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**Chapter 1: Introduction**

**Introduction**

Ayurveda, India’s ancient health care tradition, uses a unique classification system based on individual constitution at birth, or prakriti. An individual’s prakriti is the basis of a personalized medical approach in the Ayurveda system. According to Ayurveda, there are three primary phenotypic groupings, or doshas. Ayurveda’s tridosha theory consists of principles of metabolism (pitta), principles of structure (kapha), and principles of motion (vata).

The Human Genome Project has provided the basis for expanded research of biogenetic markers or genotyping. One such marker, Apolipoprotein E (Apo E) has been extensively researched regarding Alzheimer’s disease and cardiovascular disease, among other topics of research.

Chapter 1 includes the problem statement and purpose of this research study, along with a summary of the background and the significance and nature of the study. Additionally, Chapter 1 includes the hypotheses and research questions of this research study, along with the conceptual framework, definitions, assumptions, scope, limitations, and delimitations, followed by a summary of the chapter.

**Background**

**History and background of Ayurveda.** The ancient healing system of India, known as Ayurveda, dates back thousands of years and draws upon a variety of ancient documents and practices. According to Simon (1997), “The Rig Veda is a collection of more than 1,000 poems that includes many of the central concepts of Ayurveda and was composed between 1200 and 900 B.C.” (p. xxvi). Chopra and Simon (2010) noted, “Ayurveda, the 5000 year-old healing system founded in ancient India, is derived from the Sanskrit words ayus meaning life, and veda
meaning wisdom” (p. 9). Ayurveda is an approach to wellness through the prevention of illness based on a lifestyle of good nutrition, appropriate exercise, emotional well-being, and spiritual fulfillment. In India alone, more than 240 colleges offer a graduate-level degree in Ayurveda. Currently practiced worldwide, Ayurveda is now recognized and taught in many other countries.

The concept of tridosha is a cornerstone of the Ayurvedic theory of human physiological regulation through the integration of the characteristics of three doshas. The individual’s constitution at birth, known as prakriti or dosha configuration, represents the individual’s unique combination of physical and physiological characteristics. There are three primary doshas: vata, pitta, and kapha. This tridosha concept is the starting point for all diagnosis and treatment. An individual’s basic constitution plays a key role in predisposition and the prognosis of diseases, as well as treatments and recommended lifestyle. Chopra and Simon (2010) noted, “After an Ayurveda doctor determines the patient’s dosha configuration, recommendations of diet, physical activities and medical therapies can be made customized for that patient” (p. 33). The tridosha concept is central to modern Ayurveda research.

Researchers at the Institute of Genomics and Integrative Biology in New Delhi initiated the exploration of the relationships between genomics and integrative biology in 2001 (Mukerji & Prasher, 2011, p. 12). Many Ayurvedic providers and researchers have recognized this relationship as a logical research connection between Ayurveda and allopathic knowledge. The term Ayurgenomics has been coined as a way to describe all the genetic research involving Ayurveda (Mukerji & Prasher, 2011, p. 16). One of the goals of further research in Ayurgenomics is to provide a molecular basis of the principles and practices of Ayurveda that opens the door to using the Ayurveda principles of prevention and prediction in a global medical care system. Although several human genetic markers have been studied relative to the Ayurveda
doshas, literature reviewed from both the United States and India did not show any indication of a study of the human genetic marker Apo E as related to Ayurveda doshas.

**History and background of Apolipoprotein E.** According to the National Human Genome Research Institute (2012), “The Human Genome Project (HGP) was the international, collaborative research program whose goal was the complete mapping and understanding of all genes of human beings. All our genes together are known as our genome” (National Human Genome Research Institute, 2015, p. 1). In February 2001, the Human Genome Project published its first report showing the mapping of 90% of all 3 billion base pairs in the human genome. The full sequencing and final report was completed and published in April 2003. One of the human genetic markers, Apo E, has been widely studied for its relationship to Alzheimer’s disease and coronary artery disease, among other human conditions. Roses (2000) indicated, “The gene encoding Apolipoprotein E (Apo E) is a known susceptibility gene for common, late on-set Alzheimer’s disease” (p. 859). Likewise, the medical community recognized Apo E as being one of several factors in coronary artery disease in the early 2000s in several areas such as an individual’s response to high saturated fats and to supplements (Scheuner, 2003, p. 271).

**Social implications of the research question to integrative medicine and society.** Integrative medicine combines alternative or complementary therapies with traditional Western allopathic medicine. Research of human genetic markers is widely accepted in Western medicine, and it is widely accepted in Ayurveda. Had research from this study demonstrated that a statistically significant relationship existed between the Ayurveda doshas and the human genetic marker Apo E, then a new synergistic connection would have been created between these two medical approaches. A greater symbiotic relationship between Western medicine and ancient Ayurveda could fundamentally change health care as it currently exists. Western medicine
approaches health care primarily as a treatment for symptoms. Ayurveda approaches health care primarily with a preventive point of view. As the human genetic marker Apo E is connected to several significant human conditions, including Alzheimer’s disease and coronary artery disease, Ayurveda could provide new insights and methods for the prevention and treatment of these conditions. This is especially significant, as Western medicine does not offer comprehensive treatment for either condition. The outcome to society could be improved health at a reduced cost.

**Problem Statement**

The purpose of this research study was to investigate whether a statistically significant relationship exists between the primary doshas of the Ayurveda tridosha concept and the human genotyping Apo E. The problem was that no research about the relationship between the primary doshas and Apo E existed. This research study focused on two variables: the participants’ dosha and their human genetic marker Apo E. Quantitative data for both the Ayurveda doshas and the human Apo E genotype were gathered from a convenience sample of 319 volunteers. The Ayurveda dosha determination was measured using the Prakruti Dosha Mind Body Quiz. To achieve the number and diversity of study participants desired, the Apo E data were collected using two different methods. The first method was in cooperation with a physician’s office whose client base had been Apo E profiled as part of his office procedures. The physician asked his clients if they wanted to volunteer for the study. The volunteers signed the release forms that gave the doctor permission to share their Apo E information. Then each volunteer completed an Ayurvedic dosha questionnaire to furnish his or her information for this study. The second method was used for volunteers who were not clients of the above-mentioned physician. These volunteers had their Apo E data gathered by a buccal swab genetic testing kit, with laboratory
testing completed by Salimetrics Labs. The participants knew their dosha upon completing their Prakruti Dosha Mind Body Quiz as they self-tabulated results. The results of the human Apo E genotype remained confidential and undisclosed to the participants. The outcome of the data collection and analysis contributes to the body of knowledge of integrative medicine, as no previous study addressing this question was found.

**Purpose**

The purpose of the research study was to investigate whether a statistically significant relationship existed between the Ayurveda tridosha concept and the human genotyping Apo E. Both variables were qualitative, but the data collection and subsequent analysis were quantitative.

The variables of the primary Ayurveda doshas and the human genotype Apo E were studied using qualitative data collected from 319 volunteer participants. The research design called for volunteers to self-administer the Prakruti Dosha Mind Body Quiz to determine their dosha status. The first 319 volunteers who had a primary dosha instead of a secondary dosha were asked to provide their Apo E information from the doctor’s office or to provide a saliva sample using a buccal swab genetic testing kit. Each participant’s kit was coded as part of a system of maintaining confidentiality for all sample participants. This buccal swab kit was tested in Salimetrics Laboratory with coded results returned electronically. Coded results were compared to the primary dosha for each participant.

Volunteers were selected from attendees at three different professional conferences and at group informational sessions regarding Ayurveda presented by a Chopra University certified instructor. These informational sessions were advertised to the public in California, Florida, Georgia, Virginia, and Canada. All data were gathered in California, Florida, Georgia, Virginia,
and Canada. Research analysis was conducted in Florida. Informational sessions were given at universities, chamber of commerce meetings, homeowner associations, civic groups, and churches. Attendees included those somewhat familiar with Ayurveda and those who had no familiarity with Ayurveda. Most attendees had a limited understanding of human genetics. This research design was appropriate to address the research question, as the study involved collecting data directly using reliable and validated testing methods on the two variables. The total sample size was 319 participants.

**Significance of the Study**

Medical care systems are evolving around the world to address a growing need for health care in the world’s population. One such evolution is in the area of integrative medicine, whereby conventional Western medicine is combined with alternative or complementary treatments such as Ayurveda, yoga, and meditation. Energy Medicine University’s concentration of integrative health is designed to expand the ways that alternative and complementary treatments are blended with Western medicine. The variables of this study, the primary Ayurveda doshas and the human genotyping Apo E, link ancient Ayurveda and conventional Western medicine.

Evidence of a statistically significant relationship between Ayurveda doshas and human genotype Apo E could lead to new approaches of integrating Ayurveda and conventional Western medicine for both the treatment and prevention of related medical conditions. Rastogi (2012) noted, “The concept of Prakriti has remained a subject of extensive exploration in the recent past. As a result, it is now better understood in terms of its genomic and biochemical correlations and subsequent clinical applications” (p. 209). By adding the human genetic marker
Apo E to the human genotypes previously studied, blended approaches to both Alzheimer’s disease and coronary artery disease can be used.

**Nature of the Study**

The nature of this study was the specific variables of primary Ayurveda dosha and the human genotype Apo E. Given the characteristics of these variables, the quantitative research method was selected as the most direct method of comparison.

By using the standardized Prakruti Dosha Mind Body Quiz, participants provided their own dosha assessments using a long-standing and time-proven Ayurvedic university instrument. The quiz was easy to administer, score, and interpret for both the participant and the researcher. An alternative to the quiz was hiring an Ayurvedic physician to perform a clinical dosha assessment. Using an Ayurvedic physician would have taken considerably more time, and the cost was prohibitive.

Doctor’s offices routinely use Apo E testing as part of their client files. Additionally, the buccal swab has a proven history of ease and effectiveness for genetic testing. Researchers and law enforcement use the buccal swab genetic test instead of blood testing whenever possible, as the results are just as reliable. The buccal swab test is noninvasive and preferred by volunteers over blood testing. Additionally, the buccal swab test is less expensive than individual genetic blood testing.

**Hypothesis and Research Questions**

This research addressed the following research question: Is there a statistically significant relationship between primary Ayurveda doshas and human genotype Apo E that could be used to develop new preventative and treatment approaches for certain medical conditions? The hypothesis of this research study was that an analysis of data collected on the two variables,
primary Ayurveda doshas and human genotype Apo E, would show a statistically significant relationship between these variables.

The Prakruti Dosha Mind Body Quiz used by the Chopra Center in Carlsbad, California, has been in use for more than 10 years and has been used by thousands of people. This quiz served as a reliable and validated data collection instrument for this study. Deepak Chopra is one of the most recognized experts in the United States on the subject of Ayurveda and has written more than 90 books on various aspects of Ayurveda traditions and beliefs. The Prakruti Dosha Mind Body Quiz is in Appendix A.

The most common method for Apo E stand-alone research is the buccal swab method. This saliva testing is noninvasive and meets the National Human Genome Research Institute’s standards. A buccal swab, or buccal smear, collects DNA from the cells of the inside of the cheek using a swab or sponge-like device. Each genetic testing laboratory provides their buccal swab testing kits with specific requirements for that facility. Nemoda et al. (2011) noted, “Recent studies reveal that high-quality and -quantity DNA can be obtained from saliva samples” (p. 2).

**Conceptual Framework**

This proposal called for only two research variables: the primary Ayurveda dosha and the Apo E genetic marker. Both variables are well researched and represent significant elements in their respective medical systems. Both variables have three primary variations of their expression in their respective medical systems, as there are three primary doshas and three Apo E gene alleles. Ayurveda and conventional Western medicine both use these variables as indicators of predispositions to certain conditions.

Ayurveda dosha questionnaires are easily found online and in popular self-help magazines and books. Information on how to use the results of the dosha questionnaires is also
easily obtained. The U.S. government has provided millions of dollars through the National Institutes of Health to various medical research centers in India for specific Ayurveda studies. Further, the National Center for Complementary and Alternative Medicine in the United States recognizes and includes Ayurveda as a primary field of study. Ayurveda research has become a global endeavor that includes such reputable institutions as Harvard Medical School and Johns Hopkins Medical School.

On the other hand, there is limited information on how to interpret and use the human genotype Apo E, even though Apo E is one of the most widely researched genetic markers for Alzheimer’s disease and coronary artery disease. A 1998 literature review, “Limitations of Using the Apolipoprotein E Genotype in the Diagnosis of Alzheimer’s Disease,” validated research pointing to a connection between Apo E and Alzheimer’s disease. One issue raised in this document was “clinicians are searching for greater precision in the diagnosis of this disease. Apo E genotyping can improve the specificity of the clinical diagnosis of Alzheimer’s when used in sequence with clinical evaluation. But it is not a confirmatory test” (Heidenreich, 1998, p. 47). Without a confirmatory test, how to communicate Apo E test findings to patients in a useful fashion became an ethical question. Further, the medical community generally agrees that disclosure of genetic markers without medical interpretation and consultation should be avoided for ethical reasons. Therefore, participants in this study were not provided the results of their Apo E genetic tests, but were referred to their doctors for more information on genetic markers in general and Apo E in particular. Participants were asked to volunteer for the saliva sample for Apo E motivated by the fact that they are helping to expand the body of knowledge in the areas of human genetics and integrative medicine.
**Definition of Terms**

*Allele*: A gene is subcategorized as an allele when more than one version of a gene exists (McDonald, 2010).

*Apolipoprotein E (Apo E)*: A gene with multiple alleles in the human gene map. The three different versions of the Apo E allele are e2, e3, and e4, also known simply as 2, 3, and 4. Individuals have these alleles configured as gene pairs. The six possible combinations of the Apo E allele are 2/2, 2/3, 4/2, 4/4, 3/3, and 3/4. These combinations are unevenly distributed in the human population (McDonald, 2010).

*Buccal swab*: A tool used for collecting DNA from cells on the inside of the cheek using a swab or sponge-like device, also known as buccal smear (Nemoda et al., 2011).

*Dosha*: An individual’s constitution at birth, known as prakriti or dosha configuration, which represents the individual’s unique combination of physical and physiological characteristics. The three primary doshas are vata, pitta, and kapha (Chopra & Simon, 2010).

*Human genome*: An individual’s collection of all genes (National Human Genome Research Institute, 2012).

*Prakriti*: An individual’s dosha constitution at birth (Chopra & Simon, 2010).

*Tridosha concept*: The unique configuration of the characteristics of the three doshas in every individual (Shilpa & Venkatesha, 2011).

**Assumptions**

The first assumption in the study was that participants would answer the Prakruti Dosha Mind Body Quiz truthfully and accurately. Because the quiz is self-administered, the participants may have answered the questions incorrectly, or they might have had false impressions about themselves.
As this study used a convenience sample, it was assumed that the 319 participants who volunteered to participate in the data collections held in California, Florida, Georgia, Virginia, and Canada provided a viable sample for this study. If this study had shown a statistically significant relationship between the participants’ doshas and human genetic markers Apo E, it could indicate a need for a larger study with participants from other geographical areas.

It was assumed that the buccal swab sample collection process, transportation to the lab, and lab processing all had the potential for failure due to exposure. Careful attention to the administrative process of proper labeling, completion of paperwork, and appropriate handling was essential for the entire study period.

**Scope, Limitations, and Delimitations**

The scope of this project was comparing the Ayurveda primary doshas and the specific human genotype Apo E’s alleles on 319 participants. The question of dual dosha and tridosha constitutions was not addressed in this study. No other specific human genomes were included in this study. This research proposal was motivated by the underlying question of how the science recently established by the Human Genome Project and research can be linked to the ancient Indian health care system Ayurveda with the potential of affecting health care opportunities for both Alzheimer’s disease and coronary health patients. This question is part of a broad global awareness and desire to link Ayurveda concepts and principles to modern science. According to Tripathi, Patwardhan, and Singh (2011), “The entire description of human Physiology in Ayurveda is based primarily on the theory of Tridosha. . . . Recently, there have been several efforts to provide . . . some interesting genetic, biochemical, hematological or anatomical basis to the concept of Ayurveda constitution” (p. 6).
Selecting the primary dosha as one of the variables was influenced by other Ayurvedic research that isolated the primary doshas, as the combination doshas are more complex for first-time research questions. Using primary doshas follows the example of Ayurveda researcher Bhavana Prasher. Prasher et al. (2008) focused on only participants with a primary dosha typing of vata, pitta, and kapha, as these types “exhibit readily recognizable phenotypes and are more predisposed to specific diseases” (p. 10).

The selection of Apo E as the sole human genome for the second variable in this study was based on the wide recognition of Apo E as a genetic connection to Alzheimer’s disease and coronary artery disease. Roses (2000) indicated, “The gene encoding Apolipoprotein E (Apo E) is a known susceptibility gene for common, late on-set Alzheimer’s disease” (p. 859). The American Heart Association website lists Apo E as the top genetic factor for coronary artery disease, citing nine studies and confirming Apo E to be “the best studied candidate gene in the lipid field” (Humphries, Ridker, & Talmud, 2004, p. 629). The researcher had the operational capability to gather data for both variables.

Although the entire human population has a specific Ayurveda dosha type as well as a specific Apo E allele genetic typing, this study was restricted to only 319 participants out of the general population. The determination of the number of participants for this study was heavily influenced by the uneven distribution of Apo E allele combinations in the general human population. According to McDonald (2010), “The percentage of Apo E genotypes in the general population [is]: Apo E 2/2 - 1%, 2/3 - 10%, 3/3 - 64%, 4/2 - 2%, 4/3 - 18%, 4/4 - 5%” (McDonald, 2010, p. 10). To provide sufficient data for a statistically significant analysis of the Apo E 2/2 allele alone, the minimum number of participants needed was 300. It is expected that additional research will be needed in future studies to better isolate the Apo E 2/2 allele.
population as well as to answer other questions arising out of the outcome of this study. At a minimum, this study can direct future research toward more specific questions. It is possible that the outcome of this study could immediately affect the application of Ayurveda health care techniques to specific Apo E alleles, especially the 3/3 and the 4/3 alleles that represent the largest segment of the population. Individuals in the smaller percentage Apo E allele combinations could warrant additional study.

**Chapter Summary**

This chapter provided the introduction, background, and methods for the study that included the following question: Is there a statistically significant relationship between the primary doshas of the Ayurvedic tridosha concept and the human genotyping Apo E? The tridosha concept is fundamental to India’s ancient health care system. This study determined that there was no link between the tridosha concept and modern human genetics, specifically the human genotype Apo E. As Ayurveda is based on the tridosha theory, worldwide efforts have been made to establish links between scientifically established genetic, biochemical, hematological, and anatomical principles and concepts.

The human genotype Apo E is associated with an allopathic diagnosis and care for both Alzheimer’s disease and coronary artery disease. Apo E is “one of the most robust genetic associations with common disease discovered in all of medicine, yet despite 20 years of research, the reason that APOE e4 has such a profound increase of risk in AD [Alzheimer's disease] remains uncertain” (Growdon & Hyman, 2014, p. 7). These two medical conditions affect significant percentages of the world’s population.

The significance of this study was well founded and it will be the first published attempt to compare Ayurvedic doshas and the human genotype Apo E. This quantitative research study
provides a basis for future research in this area, both specifically with Apo E and with other human genotyping classifications.

The scope of this study was two variables among 319 research participants. Assumptions for this study were within normal parameters for a convenience sample of 319 volunteers. It was assumed that participants would not falsify their answers and that participants’ geographical diversity was sufficient. Further, it was assumed that the samples provided to commercial laboratories used for Apo E analysis resulted in correct analysis results.

The outcome of this research includes suggestions for new ways of thinking about methods of medical care and prevention for Alzheimer’s disease and coronary artery disease in the immediate future. Chapter 2 includes the review of literature supporting the Ayurvedic tridosha concept, the human genotype Apo E, and the methods of the study. Additionally, Chapter 2 addresses the literature survey considerations and the ethical considerations surrounding the hypothesis and the research question.
Chapter 2: Literature Survey

A Survey of Literature of the Ayurveda Tridosha Concept and the Human Apolipoprotein E Genotype

Ayurveda, India’s ancient health care tradition, uses a unique classification of the human population based on individual constitution at birth, or prakriti. The individual’s prakriti is the basis of a personalized medical approach in the Ayurveda system. According to Ayurveda, there are three primary phenotypic groupings, or doshas. Ayurveda’s tridosha theory consists of principles of metabolism (pitta), principles of structure (kapha), and principles of motion (vata). The Human Genome Project provided the basis for expanded research of biogenetic markers or genotyping. One such marker, Apo E, has been extensively researched regarding Alzheimer’s disease and cardiovascular disease, among other topics of medical research. The purpose of this literature survey was to provide the informational background for a study that would investigate whether a statistically significant relationship exists between the Ayurveda tridosha concept and the human genotyping Apo E.

Overview of Literature Survey

Professional and academic literature pertaining to the medical practice of Ayurveda, an ancient medical system still in practice, is abundant and diverse. According to Chopra and Simon (2010), “Ayurveda, the 5000 year-old healing system founded in ancient India, is derived from the Sanskrit words ayus meaning life, and veda meaning wisdom” (p. 9). Once restricted to India and the neighboring countries of Nepal and Sri Lanka, Ayurveda has become known worldwide through Ayurveda counselor training programs, visual and audio media, self-help books and programs, organizational websites, online presentations, and theses and dissertations. Citations selected for this document reflected the time period of the various subjects that were introduced
Ayurveda was broadly introduced into the United States in the 1990s. Research involving the genotyping of Apo E began before the completion of the Human Genome Project in 2003. Ayurveda and genotyping research are both ongoing. A significant number of the references selected for this literature survey were from the time frames noted above, as appropriate for each aspect reviewed. The literature pertaining to Apo E is less abundant and much more restricted to scholarly and professional journals and textbooks dating to the Human Genome Project, which was completed in 2003. Other literature includes theses, dissertations, and organizational websites. Self-help websites and clinics have started offering Apo E testing for individuals. Some literature uses italics for Sanskrit words, however most literature does not. In this document, Sanskrit words were only italicized in citations.

**Ayurveda History and Background**

The ancient healing system of India known as Ayurveda dates back thousands of years and draws from a variety of ancient and current documents. According to Simon (1997), “The Rig Veda is a collection of more than 1,000 poems that includes many of the central concepts of Ayurveda and was composed between 1200 and 900 B.C.” (p. xxvi). One of India’s most celebrated physicians, Caraka, is called the father of Ayurvedic medicine. His book, the *Caraka Sahmita* is considered the “best known fundamental book on medicine” (Pal, 1989, p. 235). The *Caraka Sahmita* contains a carefully formulated classification of diseases and treatments as well as anatomy and embryology. Translations of this and other Indian medical texts that were spread by traders possibly influenced Hippocrates and expanded medical knowledge in China during the Han dynasty. During the 18th century, British rulers suppressed Ayurveda, which resulted in the loss of many traditional practices. In 1898, members of the medical profession interested in historical aspects of medicine formed a club known as the Caraka Club in New York.
The word Ayurveda is a Sanskrit compound word that means the knowledge or science of life. The Ayurvedic approach to wellness supports the prevention of illness with a lifestyle of good nutrition, appropriate exercise, emotional well-being, and spiritual fulfillment. Thus, Ayurveda is a science in the sense that it is a “quantitative, holistic system of health and longevity” (Brar et al., 2012, p. 20).

India officially recognizes Ayurveda as a system of healing, along with conventional medicine. In 1995, the government of India established a separate department for Indian Systems of Medicine and Homeopathy currently known as AYUSH (Ayurveda, Yoga, Unani, Siddha, and Homeopathy). As of 2010, India recognized more than 240 colleges that offer a graduate-level degree in Ayurveda. The governing body responsible for the oversight of all Ayurvedic graduate-level curricula, the Central Council of Indian Medicine, has published various educational norms and standards (K. Patwardhan, Gehlot, Singh, & Rathore, 2011). India’s medical education systems follow a parallel policy model in which each traditional and modern system of medicine is taught separately. Discussion is under way to change to a bilateral medical education policy model where students from one tradition are cross-taught by experts in the other traditions. The bilateral medical educational policy system is in use in Germany, Italy, Russia, and Sweden.

Tridosha Concept of Ayurveda

An individual’s constitution at birth, known as prakriti or dosha configuration, represents the individual’s unique combination of physical and physiological characteristics. There are three primary doshas: vata, pitta, and kapha. This tridosha concept is the starting point for all diagnosis and treatment. An individual’s basic constitution plays a key role in predisposition and the prognosis of diseases, as well as treatments and recommended lifestyle.
The individual prakriti represents a design for individual wellness. According to Ayurveda, when an individual’s prakriti is in balance, then the person is in a state of wellness, or swasthya. According to Pal (1989), “Swasthya is the Sanskrit equivalent of the English word health” (p. 239). Brar et al. (2012) noted, “Any imbalance in [an individual’s] doshas will be the cause of illness” (p. 20). The Ayurvedic dosha is read and interpreted like a blueprint outlining the basis of wellness as well as innate tendencies built into the overall individual system. The Ayurveda healing system uses the tridosha concept as its foundation for the prevention of illness and as a unique personalized medical treatment for each patient. Ayurvedic doctors use each patient’s unique dosha configuration to make recommendations for diet, lifestyle, and medical therapies.

**Characteristics of Dosha Designations**

Tridosha is a cornerstone of the Ayurvedic theory of human physiological regulation through the integration of the characteristics of the three doshas. From birth, every human has varying degrees of each dosha type that function together as a unique expression of life. When these doshas are in their original configuration, a person enjoys wellness, health, and vitality. Ayurvedic practitioners look at the characteristics of each dosha to recognize any imbalance from that original configuration that may occur. Over time, dosha imbalance can result from improper diet, poor digestion, daily stress levels, and environmental factors such as pollution, pesticides, and chemicals. Shilpa and Venkatesha (2011) noted,

When we talk about imbalance of doshas, we say that person is vata, pitta or kapha dominated. This does not mean an absence of the other two doshas, but that the other two doshas are suppressed compared to the dominant dosha. (p. 16)
Each dosha has distinct characteristics and functions. In simplistic terms, vata is associated to movement, kapha to structure, and pitta to digestion. According to Mahalle, Kulkarni, Pendse, and Naik (2012),

Vata contributes to the manifestation of shape, cell division, signaling and movement, excretion of wastes, cognition and also regulates the activities of Kapha and Pitta. Kapha is responsible for anabolism, growth and maintenance of structure, storage and stability. Pitta is primarily responsible for metabolism, thermo-regulation, energy homeostasis, pigmentation, vision, and host surveillance. (p. 150)

The Ayurveda tridosha concept describes features or qualities unique to each of the primary doshas. Features include general descriptions of the physical body, behaviors, lifestyle preferences, memory, communication styles, and dispositions. Traditional and modern Ayurveda dosha characteristic lists are all very similar, mostly varying by the number of features mentioned. Popular self-help Ayurveda websites provide examples of the modern application of doshas in society, including differences in shopping style, walking style, and organizational techniques. Mahalle et al. (2012) provided a list of professionally accepted dosha characteristics, as shown in Figure 1.
Figure 1. Characteristic features of the three extreme prakriti types. From “Association of Constitutional Type of Ayurveda With Cardiovascular Risk Factors, Inflammatory Markers and Insulin Resistance,” by N. P. Mahalle, M. V. Kulkarni, N. M. Pendse, and S. S. Naik, 2012, Journal of Ayurveda and Integrative Medicine, 3, 154. Copyright 2012 by Mahalle.

The extremes of manifestation for each of the three primary doshas are illustrated in Figure 1. However, not everyone falls into one of these three primary dosha categories. Some individuals have a combination of these primary doshas with either two doshas blended together or a tridosha combination, which is rare. The two-dosha combinations are vata-pitta, vata-kapha, and pitta-kapha. If one of the two doshas is more dominant, then that dosha is listed first in the dosha label. For example, the interpretation of a pitta-kapha dosha would be that the pitta has a greater influence than the kapha. A kapha-pitta dosha would mean the kapha has a greater influence then pitta. In the case of the vata-pitta-kapha dosha, or a tridosha individual, all three doshas would be more equally represented in their prakriti.

In the case of the combination dosha prakriti, a unique blend of doshas will manifest with their own expression of features. The primary doshas more closely follow the list of characteristics shown in Figure 1. The unique combination of dosha characteristics for each individual is what determines the individuality of a person. Prakriti is specific for each
individual. Chopra (1991) noted, “We might call your prakriti your ‘psycho-physiological constitution type,’ a phrase that includes both mind (psyche) and body (physiology)” (p. 35).

**Determination of Individual Doshas**

Since ancient times, Ayurvedic patients have relied on the interpretations of their Ayurvedic practitioners to determine their prakriti and any current imbalances affecting their health. The ancient Ayurvedic script *Caraka Sahmita* (200 B.C.) described the various methods of examination used to establish doshas. These methods include observation of the body, body functions, reading of the pulse, examination of the eyes, memory, and behavioral habits such as religious observation, and sleep and eating habits. Twenty-three diagnostic criteria for dosha designation were listed. Despite the clear mention in classical texts, most techniques were handed down from guru to disciple. Over the thousands of years of use, the distinctions of the dosha categories remained consistent and are still in use today.

Ayurveda practitioners recognize that a prakriti diagnosis may have enormous implications. According to Rastogi (2012), “To make the best use of fundamental construct of Prakriti as a dependable tool of decision making in Ayurveda aiming ultimately toward a personalized medicine, we need tools that can give us reproducible results in variable settings” (p. 214). By using proven evidence-based decision making in Ayurveda, modern practitioners believe that Ayurveda will be more scientifically recognized and accepted.

In the late 1990s and early 2000s, multiple Ayurveda experts began to acknowledge the lack of a quantitative basis appropriate for the requirements of traditional research studies. R. R. Joshi (2004) noted, “Despite its comprehensive foundation, Ayurveda has not received the due scientific recognition in modern times, largely because of the lack of a quantitative basis for experimental research in its traditional practices” (p. 879). A literature review published in 2012
found 45 Ayurveda clinical trials published from 1980 to 2009 (Brar et al., 2012, p. 27) that included doshas as one of the variables. None of these 45 published trials used all 23 of the available Ayurvedic diagnostic criteria. The conclusion of this literature review was “to improve confidence in their studies, future studies should strive to correct this observed inappropriate and gross underuse of Ayurvedic diagnostic criteria in the designing of clinical studies that aim to rigorously test the effectiveness of Ayurveda treatments” (Brar et al., 2012, p. 20).

Ayurveda researchers sought easy-to-use solutions to resolve the inconsistency of dosha determination methods. Some researchers began publishing the specific method of dosha determination used in their studies. This approach led to expanded communications within the Ayurveda research and medical treatment communities, as well as expanded use of more simplistic diagnostic tools including questionnaires for the Ayurveda patients to complete. An example of the inclusion of dosha designation tools in Ayurveda research was published in 2003 by the Austrian research team of Falkenbach and Oberguggenberger. Their diagnostic questionnaire appears as Table 1. This research was conducted in a European medical facility that used Ayurveda treatments for ankylosing spondylitis and low back pain (Falkenbach & Oberguggenberger, 2003, p. 276). Patients were asked to decide which group of features (A, B, or C) would, in their view, best reflect their personal characteristics (according to Reference 8, modified, English translation). The denotations vata, pitta, or kapha were not given to the patient.
Table 1

*Example Dosha Questionnaire*

<table>
<thead>
<tr>
<th>Features</th>
<th>Vata A</th>
<th>Pitta B</th>
<th>Kapha C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Build</td>
<td>Slight</td>
<td>Normal</td>
<td>Large, fat</td>
</tr>
<tr>
<td>Skin</td>
<td>Thin, dry, rough</td>
<td>Soft, warm, pale</td>
<td>Soft, greasy</td>
</tr>
<tr>
<td>Veins</td>
<td>Easily visible</td>
<td>Slightly visible</td>
<td>Not visible</td>
</tr>
<tr>
<td>Eyes</td>
<td>Small, dry</td>
<td>Medium, often reddened</td>
<td>Large, moist</td>
</tr>
<tr>
<td>Sleep</td>
<td>Light and interrupted</td>
<td>Active, short, harmonious</td>
<td>Long and heavy</td>
</tr>
<tr>
<td>Appetite</td>
<td>Variable</td>
<td>Hearty</td>
<td>Moderate</td>
</tr>
<tr>
<td>Sweat</td>
<td>Sparse, odorless</td>
<td>Profuse, strong odor</td>
<td>Pleasant odor</td>
</tr>
<tr>
<td>Memory</td>
<td>Medium</td>
<td>Precise</td>
<td>Good, long term</td>
</tr>
<tr>
<td>Language</td>
<td>Fast</td>
<td>Loud and clear</td>
<td>Melodic</td>
</tr>
<tr>
<td>Character</td>
<td>Shy</td>
<td>Jealous</td>
<td>Caring</td>
</tr>
<tr>
<td>Behavior</td>
<td>Unsure</td>
<td>Egotistic</td>
<td>Satisfied with self</td>
</tr>
<tr>
<td>Dislikes</td>
<td>Cold, wind, dryness</td>
<td>Heat and midday sun</td>
<td>Moisture, cold</td>
</tr>
</tbody>
</table>
During the same time period, other Ayurvedic researchers sought a different solution to the same question of establishing a quantitative basis for dosha designation with the use of standardized questionnaires. Recognized as a pioneering study, researchers from the School of Bioscience and Bioengineering of the Indian Institute of Technology, Mumbai, published a biostatistical approach to quantifying the tridosha in 2004. The focus of the study was applying an algorithmic heuristic approach to the lengthy list of quantitative features commonly used by Ayurvedic doctors for dosha determination. The study involved 280 study participants and R. R. Joshi (2004) concluded, “The concept of tridosha has a sound empirical basis that could be used for the scientific establishment of Ayurveda in a new light” (p. 879).

As dean of academic studies at the Institute of Ayurveda Integrative Medicine, Bangalore, India, Alex Hankey published a multipart series of studies to establish the scientific validity of the Ayurveda tridosha concept. Hankey recognized that clinical practice provided empirical evidence for practicing Ayurveda doctors that the system worked, but that this knowledge from direct experience was insufficient for scientific acceptance within the broader allopathic medical community. Instead of clinical outcomes as the basis for the acceptance of Ayurveda, Hankey (2010) proposed four different complementary approaches: “human physiology, systems analysis of organism function, correlation on dosha and genomic variations—Ayurgenomics, and correlation of dosha and cellular function” (p. 6). Hankey’s proposal fueled global Ayurveda research. The U.S. government has provided millions of dollars through the National Institutes of Health to various medical research centers in India for specific Ayurveda studies. Further, the National Center for Complementary and Alternative Medicine in the United States recognizes and includes Ayurveda as a primary field of study. Ayurveda
research has become a global endeavor that includes Harvard Medical School and Johns Hopkins Medical School.

One continuing global area of research is the establishment of quick, reliable methods of determining one’s dosha. Published in 2011, researchers Mandeep Singh and Anil Anand from the Department of Electrical and Instrumentation Engineering at Thapar University, Patiala, India, conducted a series of four studies to broaden the scope of the empirical basis for using questionnaires in dosha determination. The first study (Singh & Anand, 2011) reviewed existing dosha determination questionnaires from various sources such as scientific journals and websites. They proposed a Principle Component Analysis questionnaire with 83 questions derived from these sources. In the second study, Singh and Anand (2011) concluded that only 31 questions of the 83 questions in the Principle Component Analysis questionnaire should be considered for further investigations based on mathematical comparisons of 100 study participants’ outcomes after they completed both the 31- and the 83-question questionnaires. In a third study, Singh and Anand (2011) established a gold standard based on the information established in their first two studies relative to a standardized questionnaire. This gold standard was then used in a fourth study (Singh & Anand, 2011) to conclude that only 13 common questions out of the 31 questions would provide acceptable results for dosha determination. This short 13-question document was called the Quick-Shot method, and they found it faster and more reliable for common ailments (Singh & Anand, 2011, b). Singh and Anand (2011) noted, “Further investigation can be made for determining Ayurvedic imbalances using a small questionnaire containing 13 questions” (p. 413).

Sanjeev Rastogi conducted a pilot study published in 2012 to validate the results of a prototype prakriti computer analysis tool in comparison with dosha evaluations or ratings
completed by practicing Ayurveda physicians. The purpose of the study was to seek more consistent meanings of dosha typing for Ayurveda patients. Additionally, Rastogi’s study focused on meeting the need for quick, reliable dosha determination to complement the extensive ongoing Ayurveda and prakriti studies. According to Rastogi, “The concept of Prakriti has remained a subject of extensive exploration in the recent past. As a result, it is now better understood in terms of its genomic and biochemical correlations and subsequent clinical applications” (p. 209). Rastogi concluded, “This study adds determinately toward the ultimate objective of evidence-based decision making in Ayurveda, a mandatory move if Ayurveda is thought to be mainstreamed as a dependable and reproducible form of medical intervention” (p. 219).

Ayurveda researchers sought a standardized personality scale in the area of psychology to assess the human psychological manifestation of the tridosha concept. Completed and published in 2011, the Mysore Tridosha scale became a widely recognized and used questionnaire for psychological purposes. Shilpa and Murthy (2011) noted, “The developed scale has satisfactory reliability and validity indices. Thus, it could be used to assess psychological manifestations of Vata, Pitta and Kapha among human beings” (p. 312).

In 2013, an Ayurveda research team from Denmark published a study in which they compared the dosha determination reliability and accuracy of questionnaires against 15 registered Ayurveda doctors with 3 to 15 years of Ayurveda practice experience. The study team of Kurande, Bilgrau, Waagepetersen, Toft, and Prasad (2013) concluded that the use of an “objectively defined questionnaire and software analysis in establishing prakriti assessment” (p. 10) is recommended as it is “a method which yields more reliable results” (p. 10) compared to other diagnostic methods. An abundance of online questionnaires provides users with a way to
determine their prakriti and dosha imbalance. The questionnaire for these various self-help tools reflects the studies reviewed here. Each questionnaire usually has similar if not the same questions, but use differing fonts, layouts, and formats. One such online questionnaire has been used by the Chopra Center in Carlsbad, California, for more than 10 years, with thousands of individuals using this dosha designation successfully. Deepak Chopra, founder and president of the Chopra Center, is an internationally recognized author and lecturer on Ayurveda and related subjects. With more than 90 books to his credit, Chopra has played a key role in the introduction and spread of Ayurveda within the United States over the past 30 years. The Chopra Center Prakruti Dosha Mind Body Quiz is shown in Appendix A. Other online dosha questionnaires include one used by the well-known Dr. Oz on his television show, and Yoga International uses another.

A comprehensive Ayurveda software known as AyuSoft has been developed and promoted by the Center for Development of Advanced Computing, Pune University Campus, Pune, India. This integrated system offers multiple interconnected applications and databases to diagnose not only prakriti at both the psychological and physiological levels, but also tissue quality assessment, a disease diagnostic with Ayurvedic treatment recommendations, and Ayurvedic diet and lifestyle recommendations. This information management system provides an Ayurveda encyclopedia, as well as textual and graphical analytical report tools applicable to Ayurveda professionals and clinical and research centers. Additionally, AyuSoft assists with language barriers, as Ayurveda providers are global. As more professionals begin to use AyuSoft, the database will become an increasingly useful resource for trend analysis and an indicator of potentially useful research topics.
Apolipoprotein E: History and Background

Human genetics is a commonly recognized concept in the 21st century, but it was relatively unknown 100 years ago. In 1911, Alfred Sturtevant first created the genetic map for the fruit fly, Drosophila, in a pioneering breakthrough that launched multiple research efforts. The next major research breakthrough occurred in 1953 with the discovery of the double helical structure of the DNA molecule by Francis Crick and James Watson. Subsequent evolutions in genetic research led to the creation of the Human Genome Project in the 1980s with the support and involvement of multiple U.S. government agencies, as well as with funding from Congress. “The Human Genome Project (HGP) was the international, collaborative research program whose goal was the complete mapping and understanding of all genes of human beings. All our genes together are known as our genome” (National Human Genome Research Institute, 2015, p. 1). In February 2001, the Human Genome Project published its first report showing the mapping of 90% of all 3 billion base pairs in the human genome. The full sequencing and final report was completed and published in April 2003. These reports revealed there “are probably about 20,500 human genes” (National Human Genome Research Institute, 2015, p. 1), which was considerably less than first anticipated in the early years of Human Genome Project.

A gene is subcategorized as an allele when more than one version of a gene exists. An individual inherits two alleles for each gene, one from each parent. If the inherited alleles are the same, then that individual is homozygous for that gene. If the alleles are different, the individual is heterozygous for that gene. Apo E is a gene with multiple alleles in the human gene map. There are three different versions of the Apo E allele, known as e2, e3, and e4 or as 2, 3, and 4. Individuals have these alleles configured as gene pairs. The six possible combinations of the Apo E allele are 2/2, 2/3, 4/2, 4/4, 3/3, and 3/4. These combinations are unevenly distributed in the

The human gene Apo E may appear written in various ways. The most common are APOE, Apo E, and APOE-Human but there are also other variations. For this study, Apo E was used, unless in a citation in which the author used another variation.

The normal function of the Apo E gene is to provide instructions to the human body to make a protein called Apo E. Apo E combines with lipids in the human body to form a molecule called a lipoprotein. Lipoproteins carry cholesterol and other fats through the bloodstream. Apo E plays a key role in maintaining normal levels of cholesterol, as it is a major component in very low-density lipoproteins. These very low-density lipoproteins carry excess cholesterol to the liver for processing and removal from the body to maintain proper balance. Properly balanced cholesterol levels have been associated with the prevention of cardiovascular diseases, including heart attacks and stroke. Once an individual’s Apo E allele configuration has been determined, a physician can use this information to recommend a diet and lifestyle that will encourage the body to self-regulate cholesterol levels.

**Determination of Individual Apo E**

The completion of the mapping of the human genome and subsequent findings about specific genes related to prediction, prevention, and treatment of disease have presented many opportunities to change clinical practice. The most commonly used genetic tests include breast cancer and colorectal cancer prediction, as well as the prediction of optimal chemotherapy protocols and other patient drug responses. According to the National Human Genome Research Institute (2012), “Genomic medicine has the capacity to revolutionize clinical practice, but if
insurance companies and Medicare are unwilling to pay for genetic testing, this important progress will be stalled” (p. 1).

Several governmental agencies have worked together to standardize regulatory requirements for genetic testing laboratories. Further, these agencies have outlined the comprehensive integration of genetic testing into routine medical care. From these standards, many genetic testing laboratory facilities have been registered and certified and are functioning to provide a full range of genetic testing in the United States and abroad.

In the specific case of genetic testing for Apo E, both blood and saliva samples are used. The most common method for Apo E is the buccal swab method. This saliva testing is noninvasive and meets the National Human Genome Research Institute’s standards. A buccal swab, or buccal smear, collects DNA from the cells on the inside of the cheek using a swab or sponge-like device. Each genetic testing laboratory provides buccal swab testing kits with specific requirements for that facility. The buccal swab is commonly used in clinical trials as well as law enforcement. Nemoda et al. (2011) noted, “Recent studies reveal that high quality and quantity DNA can be obtained from saliva samples” (p. 2).

The buccal swab was used early on in genetic testing and has remained a standard test method ever since. In 2004, researchers from the University of Pennsylvania and John Hopkins School of Medicine worked together on a study of 342 adults that included testing the Apo E allele with a buccal swab method. The purpose of their study was to determine the benefits of using a buccal swab for Apo E genetic testing in a primary care study. In addition to the specific question of the buccal swab use, the report also concluded that “the consent form should clearly spell out what is being asked of participants and what will happen to the specimens and the
information provided” (Bogner et al., 2004, p. 8). Genetic testing standards now include specific standard forms for consent, confidentiality, and the release of test information.

Salimetrics Laboratory is an example of a successful global genetic testing laboratory. According to its website, Salimetrics is “widely regarded as a global leader in salivary bioscience because in many instances, we pioneered the science and technology that supports the field” (Salimetrics, 2014). Salimetrics provides saliva tests in the areas of aging and wellness, obesity and diabetes, posttraumatic stress disorder, sleep and circadian rhythm, stress, reproductive health, sport and exercise science, inflammation, puberty and child development, and environmental issues. The full services offered by Salimetrics are available online and for use around the world. One of the saliva tests offered by Salimetrics is the buccal swab for Apo E genetic testing. An example of a Salimetrics report is found in Appendix B.

**Ethical Questions Surrounding Genetic Testing**

In the 1980s, global development of new and complex clinical genetic testing services burgeoned. These genetic testing services brought ethical questions to the forefront as technology drove the speed at which genetic testing was being offered and used. The standardization of processes and procedures for when and how to use the services lagged behind the capability to do the actual genetic testing in the laboratory. As genetic data began increasing in data banks, ethical questions emerged and expanded in scope as professional and public awareness grew. Governmental agencies recognized the ethical issues and commissioned various studies. The Institute of Medicine’s Committee on Assessing Genetic Risks published a report of their study in 1994. The National Institutes of Health, Department of Energy, Working Group on the Ethical, Legal, and Social Implications (ELSI) of Human Genome Research reviewed the committee’s report and concluded,
Among the concerns raised in that report were the imperfect predictability of tests, the quality of laboratories providing clinical genetic tests, the lack of proven interventions for many disorders, and the limited ability of many health care providers to explain genetic tests accurately and non-directly to patients. (National Human Genome Research Institute, 2005, p. 2)

In recognition of the magnitude and scope of the issues surrounding genetic testing, the ELSI continued its work to improve genetic testing with safe and effective testing parameters, including no harm to those involved.

Among the original standards recommended in 1995 by the ELSI for genetic testing were the principles of informed consent and confidentiality. Since 1995, the National Human Genome Research Institute has maintained publication of the most current documentation and processes required for human genetic research on their website. The informed consent document (Appendix C) in this paper includes the elements of informed consent described in the Code of Federal Regulations at the time of this research. A distinction is made between the documentation and the process requirements when human blood is collected. The buccal collection method does not require human blood collection.

Researchers and medical care providers still contend with multiple ethical issues surrounding genetic testing that are not addressed by the requirements of the Informed Consent section of the Code of Federal Regulations. The primary ethical concern centers on the provision and limited ability to provide useful interpretation and recommendations regarding the results of the genetic test. The growing number of companies that offer genetic testing direct to consumers has exacerbated these concerns. Fueled by the desire for profit, these direct-to-consumer companies use the information from the Human Genome Project and the power of the Internet
for marketing. According to Hogarth, Javitt, and Melzer (2008), “Government oversight of direct to consumer genetic testing . . . is quite limited” (p. 162). In 2008, more than 25 companies offered various genetic testing services directly to consumers and primarily marketed over the Internet. Most of these companies send results to the consumer without medical consultation. A few companies are more restrictive, such as Kimball, which provides test results to consumers and their physician “with mandatory detailed telephone consultation with [a] certified counselor” (Hogarth et al., 2008, p. 167).

By 2005, more than 500 commercial, university, and health department laboratories offered various genetic testing services. Both the number of testing facilities and tests offered continue to grow each year. The ethical concerns regarding these facilities and testing continue to be similar. According to the National Human Genome Research Institute (2005), some new genetic tests are “introduced before they have been demonstrated to be safe, effective and useful” (para. 20) and another problem is “there is no assurance that laboratories performing genetic tests for clinical purposes meet high standards” (para. 20); also, “the informational materials distributed by academic and commercial genetic testing laboratories do not provide sufficient information to fill in gaps in providers’ and patients’ understanding of genetic tests” (para. 20).

Over the years, various professional associations and certification bodies have been established to address ethical questions and professional needs regarding genetic testing services. The American Society of Human Genetics (ASHG), established in 1948, provides professional leadership in research, education, and service in human genetics. In addition to an annual meeting and educational program, ASHG sponsors the publication of the American Journal of Human Genetics. ASHG (2010) noted, “The Annual Meeting has grown to have an attendance of 6000 or more each year” (para. 1). The National Society of Genetic Counselors was formed in
1979 as an advocacy group for genetic counseling. In 1981, the American Board of Medical Genetics was founded as a certification board for genetic counselors. The American Board of Genetic Counseling established a master’s degree program for genetic counselors in 1991. In 1993, ASHG was “accorded full membership in the Council of Medical Specialty Societies and is now the recognized body representing doctoral level laboratory and clinical practitioners of medical genetics in the United States” (ASHG, 2010, para. 2). In 2015, the American Board of Medical Genetics recognized more than 3,000 genetic counselors and 30 graduate programs.

The Centers for Disease Control and Prevention (CDC) is responsible for the administration and oversight of the Clinical Laboratory Improvement Amendments of 1988 (CLIA). These federal regulations apply to all U.S. facilities and sites that test human specimens for health assessment or to diagnose, prevent, or treat disease. Laboratories that conduct genetic testing fall under the CDC’s jurisdiction.

The CDC’s responsibilities for the national CLIA program include the following (CDC, 2013):

- Providing analysis, research, and technical assistance.
- Developing technical standards and laboratory practice guidelines, including standards and guidelines for cytology.
- Conducting laboratory quality improvement studies.
- Monitoring proficiency testing practices.
- Developing and distributing professional information and educational resources.
- Managing the Clinical Laboratory improvement Advisory Committee (CLIAC).

The requirements and monitoring of U.S. medical laboratories by CLIA provide a level of assurance to the public of the standards offered.
The Role of Doshas in Modern Ayurveda Research

A review of secondary modern Ayurveda research revealed that the majority of Ayurvedic research studies center on validating the role of the tridosha theory based on Western research methods. Ayurveda doctors are using Ayurveda methods in their daily practice, and Ayurveda research is primarily being done to explain Ayurveda in Western terms. The tridosha concept is central to modern Ayurveda research. Research completed by Tripathi and his research team in 2011 documented worldwide efforts to link the Ayurveda tridosha concept to genetic, biochemical, hematological, and anatomical research-related studies (Tripathi et al., 2011, p. 6).

Prior to modern times, Ayurveda was practiced as a holistic medical system. Doctors practiced their art based on their experience and knowledge centered on the tridosha concept. According to Pal (1989), “How an Ayurvedic physician applies the tridosha theory in determining the ground for appearance of disease . . . involves more of an art, which requires a good deal of practical experience to be gained over a period through training from an expert practitioner of Ayurveda” (p. 6). Kaviraj Gananath Sen (1887-1944) was among the first modern Ayurvedic doctors who sought to “read tridosha theory in the light thrown by modern science” (Pal, 1989, p. 5). Since 1989, the Indian medical research community has developed a robust research program. Representative examples of the scope and approach of Ayurveda medical research excluding genotype research follow.

In 2010, the research article, “The Basic Cardiovascular Responses to Postural Changes, Exercise, and Cold Pressor Test: Do They Vary in Accordance With the Dual Constitutional Types in Ayurveda?” was published in Evidence-Based Complementary and Alternative Medicine. The research team from the Institute of Medical Sciences at Banaras Hindu University
was led by Piyush Kumar Tripathi, faculty of Ayurveda. The starting premise for this study was as follows: “According to Ayurveda, the native Indian system for healthcare, three doshas, namely, vata, pitta and kapha, are the basic mutually reciprocal mechanisms that are responsible for the maintenance of homeostasis in human beings” (Tripathi et al., 2011, p. 1). In general, Tripathi et al. concluded that the basic cardiovascular responses do not vary significantly as per the dual constitution (dosha typing). However, the pitta-kapha and vata-pitta duel constitutions showed a significant fall in diastolic blood pressure following the isotonic exercise. The research team interpreted this significant fall in diastolic blood pressure to indicate “some kind of positive association of Pitta with adrenal medullary hormones, sympathetic activity and/or such other mechanisms that regulate the total peripheral resistance” (Tripathi et al., 2011, p. 8). Further, the research team proposed conducting this same research on individuals with only a single dosha constitution. The recommendation of this study to focus on primary dosha individuals instead of those with dual doshas is of significance with regard to determining if an association exists between doshas and the genetic marker Apo E.

Purvya and Meena (2011) investigated the role of prakriti in aging. Drawing from both ancient Ayurveda texts as well as modern publications, the conclusion from this review was that “aging is closely related with prakriti and can be delayed by using Kapha predominant” (Purvya & Meena, 2011, p. 24) lifestyle and treatment practices. This review is important to the possible relationship between prakriti and Apo E because it could also suggest possible treatments and protocols based on Ayurveda for those with the Apo E 4 allele.

Bhalerao, Deshpande, and Thatte (2012) recruited 137 participants for a study titled “Prakriti (Ayurvedic Concept of Constitution) and Variations in Platelet Aggregation.” Published in 2012, this research team concluded, “Our results suggest that identifying the prakriti may help
in individualizing therapy or predicting proneness to a disease” (Bhalerao et al., 2012, p. 1). Bhalerao et al. mentioned the significance of the primary dosha for further study: “These findings suggest that the predominant dosha determining prakriti might be playing a major role in the process of platelet aggregation” (p. 4).

Prasuna and Srinivasulu (2013) published the results of their research regarding the significance and the role dosha plays in hypothyroid symptoms. Selected randomly from patients at Sagalal Memorial Hospital with proven hypothyroidism, 100 participants were grouped according to their prakriti, and their clinic features were studied. Prasuna and Srinivasulu concluded that prakriti “plays a role in the manifestation of clinical features of hypothyroid patients” (p. 22). A more general conclusion from this study that has implications for other studies involving prakriti is that “prakriti plays a very important role on the manifestation of disease and it is also possible to predict the probable clinical features of each prakriti type” (Prasuna & Srinivasulu, 2013, p. 22).

Ayurveda and Genotype Research

The Institute of Genomics and Integrative Biology in New Delhi initiated the exploration of the relationships between genomics and integrative biology in 2001 (Mukerji & Prasher, 2011, p. 12). Many Ayurvedic providers and researchers have recognized this relationship as a logical research connection between Ayurveda and allopathic knowledge. Researchers began to use the term Ayurgenomics as a way to describe the various genetic research involving Ayurveda (Mukerji & Prasher, 2011, p. 16). One of the goals of further research in Ayurgenomics is to provide a molecular basis of the principles and practices of Ayurveda that opens the door to using the Ayurveda principles of prevention and prediction in a global medical care system.
Published in 2005, Bhusham, Kalpana, and Anvind’s “Classification of Human Population Based on HLA Gene Polymorphis and the Concept of Prakriti in Ayurveda” is a milestone pilot study of 76 participants where a reasonable correlation between human leucocyte antigen (HLA) type and prakriti type was observed. The recommendation was made to study the relationship between doshas and the human genetic structure further. If their hypothesis of such a relationship is validated, then “far reaching implications for pharmacogenomics, modern genetics, human health and Ayurveda” (Bhushan, Kalpana, & Arvind, 2005, p. 349) would be seen.

In 2008, Patwardhan and Bodeker asked, “Given a theoretical and statistical basis for Ayurveda typology, must there not also be a genetic basis” (p. 572)? Referring to various publications in the Journal of Alternative and Complementary Medicine during the 6 preceding years (2002-2008), the authors pointed out various centers of Ayurveda study, including the focus on the field of pharmacogenomics at Manipal University in Karnataka, India. They also mentioned AyuSoft, the software system referred to earlier in this paper, as “a valuable tool to provide system standardization for an integrated, intelligent and communicative decision support system based on Ayurveda” (Patwardhan & Bodeker, 2008, p. 574).

Eighteen human genes were considered for analysis in the study “Whole Genome Expression and Biochemical Correlates of Extreme Constitutional Types Defined in Ayurveda with Lead Researcher Bhavana Prasher” (Prasher et al., 2008) Prasher et al. (2008) focused on only participants with a primary dosha typing of vata, pitta, and kapha, as these types “exhibit readily recognizable phenotypes and are more predisposed to specific diseases” (p. 10). Dosha typing was completed using a questionnaire. Based on observations from this study, “the extreme constitution types revealed differences at gene expression level as well as biochemical levels and
also included genes with reported disease involvement” (Prasher et al., 2008, p. 10). This study was completed on a small dataset of 96 participants with a recommendation by the research team to conduct more rigorous study. The Apo E genetic marker was not among the genes analyzed in this study.

Variance of metabolism between the doshas is an element of the Ayurveda tridosha concept. The CYP2C19 gene was selected for an Ayurveda dosha relationship, as the gene is reported to be involved with the metabolism of a number of drugs in humans. Ghodke, Joshi, and Patwardhan (2011) concluded an “association between CYP2C19 genotype and Ayurveda-based constitution or Prakriti” existed (p. 1). A questionnaire was completed to establish prakriti, and only 167 individuals with primary doshas of vata, pitta, and kapha were included as study participants.

Beginning in 2010, the literature expanded to include articles and professional discussion on the variety of ways that Ayurveda and genetic research could synergistically support each other (K. Joshi, Ghodke, & Shintre, 2010). The concept of treatment customization for each patient in the area of drug therapy based on an Ayurvedic understanding of human metabolism based on the tridosha concept would change the face of medical care. Ayurveda used in conjunction with functional genetics “could initiate a plethora of scientific projects that will answer crucial questions about the foundations of human physiology, and lay out strategies for developing scientifically validated approaches to preventive medicine, chronic disease care and treatments” (K. Joshi et al., 2010, p. 32).

Some diseases, such as diabetes, asthma, cardiovascular disorders, stroke, and mental disorders, are heavily attributed to lifestyle choices. These diseases were the focus of a 2011 article by Mukerji and Prasher titled “Ayurgenomics: A New Approach in Personalized and
Preventive Medicine.” Recognizing that these same diseases are attributed to being “inherited in the families” (Mukerji & Prasher, 2011, p. 10, the authors urged an expansion of Ayurveda and genetic testing research as a means to “accelerate/assist predictive marker discovery” (p. 12) and apply the Ayurveda principles and treatments that have been used for thousands of years. Mukerji and Prasher noted, “Ayurveda has a personalized approach in predictive, preventive and curative aspects of medicine” (p. 12). Emphasizing the personalized approach of Ayurveda in a slightly different way, Basisht (2011) described the allopathic medical approach as finding out “why does an apple fall to the ground” (p. 6) compared to the Ayurveda approach of finding out “what keeps the apple attached to the tree for so long” (p. 6). Blending both the Ayurveda and the allopathic approaches is what Basisht called Symbiohealth. Basisht’s concept of Symbiohealth includes all validated knowledge from genetic testing into the blending of allopathy and Ayurveda, although there is not a specific mention of genetic testing.

Drawing from their own recent studies, as well as other published work, Sethi, Prasher, and Mukerji (2011) published an updated overview of Ayurveda and genetics in “Ayurgenomics: A New Way of Threading Molecular Variability for Stratified Medicine.” Referring back to their earlier studies, the authors reinforced the observed significant differences between healthy individuals who have primary dosha types of vata, pitta, and kapha in the areas of genetic alleles and genetic expression as well as gross biochemical levels in peripheral blood samples. Sethi et al. proposed that a fully developed field of Ayurgenomics would be useful for the “prevention of disease and maintenance of health, early detection, diagnosis and screening of the pre-diseased state and customized screening based on personal risk” (p. 875) and “development of a tailored treatment regime after the onset of disease to improve prognosis and quality of life” (p. 875).
Calling for a “lifetime of personalized prevention,” Dey and Pahwa (2014) presented their case for newborn genetic screening for prakriti in their review “Prakriti and Its Associations With Metabolism, Chronic Diseases and Genotypes: Possibilities of Newborn Screening and a Lifetime of Personalized Prevention” published in *Journal of Ayurveda and Integrative Medicine*. Citing nine articles linking prakriti and genetics, genomics, or genotypes, Dey and Pahwa concluded that research of prakriti and genetics was sufficient to confirm it as valid science. Based on their conclusion from this literature review, they recommended that the widespread application of prakriti and genotype screening of newborns be used for lifetime medical treatment recommendations (Dey & Pahwa, 2014, p. 22).

**Allopathic Research Involving Apo E**

Information and data obtained from the completion of the Human Genome Project in 2003, coupled with high-capacity computer technologies, significantly contributed to the speed and scope of genetic research in general. Research regarding the Apo E genetic marker was among the first to be singled out and began even before the total human genome mapping was completed. Zannis, Just, and Breslow (1981) explained “the genetic basis for the common variation in a human plasma protein, Apo E” (p. 11). Building on Zannis’s milestone research findings, other topics for research regarding Apo E began to emerge, including dietary fat clearance (Weintraub, Eisenberg, & Breslow, 1987), Alzheimer’s disease (Post et al., 1997), and cholesterol variations with connection to coronary artery disease (Ordovas & Schaefer, 2000).

A 1998 literature review, “Limitations of Using the Apolipoprotein E Genotype in the Diagnosis of Alzheimer’s Disease” (Heidenreich, 1998), validated research pointing to a connection between Apo E and Alzheimer’s disease. One issue raised in this document was “clinicians are searching for greater precision in the diagnosis of this disease. Apo E genotyping
can improve the specificity of the clinical diagnosis of Alzheimer’s when used in sequence with clinical evaluation. But it is not a confirmatory test” (Heidenreich, 1998, p. 47). Without a confirmatory test, the ethical question became how to communicate Apo E test findings with patients in a useful fashion. The literature review included a recommendation for future cohort studies to ascertain the degree of absolute risk of each Apo E genotype for Alzheimer’s disease. It is notable with regard to a possible connection between Apo E and Ayurveda doshas that the doshas might provide some insight why some individuals develop Alzheimer’s disease and others do not.

Ordovas (1999) published a review of studies regarding the role of Apo E, among other genetic markers, to serum lipid responsiveness and dietary interventions. The 28 studies specific to the Apo E genetic marker began in 1983 and continued to immediately before the date of Ordovas’s published review in 1999. Ordovas determined that Apo E was the “most studied, and the current evidence suggests that this locus might be responsible for some of the inter-individual variability in dietary response” (Ordovas & Schaefer, 1999, p. 185). Based on conflicting study results reviewed, Ordovas noted additional studies were needed to reconcile the available information.

Following Ordovas and Schaefer’s (1999) paper, research involving Apo E began to shift and expand across the globe to include more specific topics and focused research questions. A Finnish study of centenarians concluded, “Carriers of the e2 allele of Apo E might be predisposed to reach extremely old age” (Frisoni, 2001, p. 633). Specific questions about diet implications and the variants of the genetic marker Apo E were explored in “APOE Polymorphism and the Hypertriglyceridemic Effect of Dietary Sucrose” (Erkkila et al., 2001) in the American Journal of Clinical Nutrition. This Finnish research study yielded the conclusion
that in “coronary artery disease patients with the E2 allele will likely have a greater triaclglycerol response to high dietary sucrose intakes than will patients with the E3 or E4 allele” (Erkkila et al., 2001, p. 746). The role Apo E plays in dietary response was a significant topic of discussion following a presentation at the 2002 Symposium on Nutrition in the postgenomic era held in London in February 2002. What foods humankind has had available to eat has changed radically over history, whereas the human genetic makeup has evolved little over the same period. This symposium included a discussion and a subsequent article centered on the variation of response in different individuals from the same diet representing the manner in which human genetics evolved. The Apo E allele was one of the main genetic markers discussed at the London symposium (Vincent et al., 2002, p. 428). A genetic revolution is under way, with a move toward personalized diets based on genetics and with Apo E being a main genetic marker considered for each individual (Arab, 2004, p. 168). Individual nutritional counseling based on Apo E is provided as a comprehensive program through various medical and nutritional counselors. A well-known example is internationally known speaker Pamela McDonald, author of *The Perfect Gene Diet: Use Your Own Body’s ApoE Gene and an Integrative-Medicine Approach to Treat High Cholesterol, Weight Problems, Heart Disease, Alzheimer’s—And More*, which is a book devoted to customizing diets for preventing and treating high cholesterol, weight problems, heart disease, and Alzheimer’s (McDonald, 2010).

Other specific topics researched to consider Apo E’s role did not bear positive results. Using a grant from the Parkinson’s Disease Foundation, Goetz et al. (2001) used a case-controlled matching of visual hallucinations with the patterns seen in Parkinson’s disease patients and concluded that there was no association between visual hallucinations in Parkinson’s
An additional conclusion from the study was the Apo E “allele 2 may merit further study” (Goetz et al., 2001, p. 211) to review dopaminergic receptor genetic variants.

Apo E’s relationship to both Alzheimer’s disease and coronary artery disease is one of the most studied genetic markers. As early as 2000, the medical community widely accepted that the Apo E genetic marker was associated with Alzheimer’s disease. Roses (2000) noted, “The gene encoding Apolipoprotein E (Apo E) is a known susceptibility gene for common, late on-set Alzheimer’s disease” (p. 859). Likewise, the medical community recognized Apo E as being one of several factors in coronary artery disease in the early 2000s in several areas such as an individuals’ response to high saturated fats and to supplements (Scheuner, 2003, p. 271). The American Heart Association website lists Apo E as the top genetic factor for coronary artery disease, citing nine studies and confirming Apo E to be “the best studied candidate gene in the lipid field” (Humphries et al., 2004). A similar research study history of the relationship of Apo E to Alzheimer’s disease was first reported in 1993. Apo E is “one of the most robust genetic associations with common disease discovered in all of medicine, yet despite 20 years of research, the reason that APOE e4 has such a profound increase of risk in AD remains uncertain” (Growdon & Hyman, 2014, p. 7).

**Gaps in Literature**

Literature was readily available for the subjects of both Ayurveda and Apo E. Ayurveda is an ancient medical system dating back some 5,000 years and was preliminarily introduced in the United States and Europe starting in the 1800s and more extensively starting in the 1990s by Deepak Chopra. The background information for Ayurveda selected for this document came from the best literature to understand this broad topic. No apparent gaps in the literature exist for the subject of Ayurveda.
The Human Genome Project was completed in 2003 after some 90 years of genetic research. Research regarding the human gene known as Apo E began before 2003 and continues. Considerable literature exists regarding many diverse aspects of Apo E. However, no literature was found that links Apo E to the topic of Ayurveda doshas. Therefore, this study specifically addresses this topic.

**Discussion of Research Variables**

This proposal included only two research variables: the Ayurveda tridosha concept of prakriti and the Apo E genetic marker. Both variables are well researched and represent significant elements in their respective medical systems. Both variables have three primary variations of their expression in their respective medical systems, as there are three primary doshas and three Apo E gene alleles. Ayurveda and allopathic medicine both use these variables as indicators of predispositions to certain conditions.

The Ayurveda prakriti was determined using a questionnaire completed and self-administered by study participants. As Ayurveda has become much more common in everyday American life, prakriti (dosha) questionnaires are available online and used by thousands of individuals every day. Using the results of these self-administered questionnaires can be as simple as self-help books readily available to recommend diet, lifestyle, exercise, and relaxation techniques. Individuals can also consult with one the growing number of Ayurveda practitioners and consultants in the United States. This study used a self-administered questionnaire with the participants knowing the results of the test immediately. Only those participants whose results were clearly primary dosha constitutions were eligible for the next phase of the research plan.

Human genetics is widely known, and people understand their genetic makeup is unique to them. However, the implications of the Apo E genetic marker are complex and require expert
medical guidance on how individuals can benefit from knowing their allele configuration. For this reason, study participants were not told their Apo E genetic test results. Instead, they were informed about the Apo E gene in general and advised that if they were interested in knowing more, they should consult with their doctor. Complete disclosure was provided prior to a participant’s decision to volunteer for the study. Salimetrics was selected as the laboratory for the Apo E genetic testing and Salimetrics test kits were used.

**Conclusion**

The literature reviewed for this survey confirmed that the Ayurveda tridosha concept and the Apo E genetic markers are significantly recognized and used by their respective medical communities. Based on the literature reviewed, there has not been a study with these two specific variables. Further, it was reasonable to assume that research involving a possible connection between them could be accomplished in this study. The completion of this research adds to the body of knowledge about both Ayurveda and human genetics. If a connection between the Ayurveda tridosha concept and the human Apo E genotype was proven, then radical new clinical thinking about the prevention and treatment of coronary artery disease and Alzheimer’s diseases, as well as other types of human medical conditions, could have been considered.

**Chapter Summary**

Once restricted to India and the neighboring countries of Nepal and Sri Lanka, the ancient medical system of Ayurveda is used worldwide as an effective prevention and alternative treatment for medical needs. According to Chopra and Simon (2010), “Ayurveda, the 5000 year-old healing system founded in ancient India, is derived from the Sanskrit words ayus meaning life, and veda meaning wisdom” (p. 9). The tridosha concept is the foundation of personalizing Ayurvedic treatment and practice for each patient. Standardized dosha questionnaires provide
quick and reliable determinations of each individual’s prakriti, as well as current dosha imbalances. These easy-to-use questionnaires have empowered more medical caregivers to incorporate Ayurveda principles into their practices. R. R. Joshi (2004) noted, “The concept of tridosha has a sound empirical basis that could be used for the scientific establishment of Ayurveda in a new light” (p. 879).

The mapping of the human genome by Human Genome Project was completed in April 2003. Human genetics provided a new scientific approach to disease and medical condition predetermination and in some cases prevention. According to the National Human Genome Research Institute (2012), “Genomic medicine has the capacity to revolutionize clinical practice” (p. 1). The Ayurveda research community recognized the new potential for using human genetics as a tool to further the understanding and use of Ayurveda principles in allopathic medicine and started the Institute of Genomics and Integrative Biology in New Delhi in 2001 (Mukerji & Prasher, 2011, p. 12). Although many different human genes have been part of various Ayurveda genetic studies, no researchers have used the Apo E allele. Many of the genes researched have been linked to participants’ dosha. For example, Ghodke et al. (2011) concluded an “association between CYP2C19 genotype and Ayurveda-based constitution or Prakriti” existed (p. 1). Since 2003, the allopathic research involving Apo E has been extensive, with a focus on both Alzheimer’s disease and coronary artery disease. Apo E is the “most studied, and the current evidence suggests that this locus might be responsible for some of the inter-individual variability in dietary response” (Ordovas & Schaefer, 1999, p. 185).

If this research study determined that a link existed between the Ayurvedic doshas and Apo E, then the results of this study would have affected the medical and Ayurvedic communities. The research method and design are outlined and summarized in Chapter 3.
Chapter 3: Methodology

Research Method and Design Appropriateness

The purpose of this exploratory study was to determine if a statistically significant relationship exists between the Ayurveda tridosha concept and the human genotyping Apolipoprotein E in a sample size of 319 participants. Study participants evaluated themselves according to their Ayurveda dosha characteristics using the self-administered questionnaire from the Chopra Center. Those who ranked with a single dosha were asked to provide their Apo E from their doctor’s office or to participate in a buccal swab test to determine their human Apo E genotyping. The results of the genotyping were compared to the dosha results. The hypothesis was that there would be a statistically significant relationship between these two sets of data. The variables in this study were the participants’ Ayurvedic dosha and human Apo E genotyping.

Population, Sampling, Data Collection Procedures, and Rationale

The goal of this proposed study was to test approximately 300 participants for their human Apo E genotype. The participants were a convenience sample drawn from individuals who had voluntarily participated from their doctor’s office or attended information sessions about Ayurveda and this study. These informational sessions were presented at civic groups, chamber of commerce meetings, university settings, homeowner association meetings, and church groups. It was expected that this diversity of meeting places and times would be necessary to have 300 participants in the study who tested as a single dosha.

Conceptualization and operationalization. The study included three phases of operationalization. The first phase was a pretest to experience the operational ease of using the standardized Ayurveda dosha questionnaire. With 25 volunteers for this pretest, the goal was to determine if there were any unforeseen operational issues regarding the administration of the
questionnaire. Examples of issues were confusing language and difficulty self-scoring. The second phase was advertising to various large groups and inviting them to attend an informational session about Ayurveda and this study. Attendees at these sessions were invited to volunteer to complete the Ayurveda dosha questionnaire. Phase 3 was asking the volunteers who had evaluated themselves and had a single dosha (vata, pitta, and kapha) to participate in the testing for the human Apo E genotype.

**Determination process of Ayurveda doshas.** Individual Ayurveda doshas were determined using the self-administered standardized questionnaire used by the Chopra Center in Carlsbad, California. This questionnaire has been used by thousands of individuals at the Chopra Center for more than 10 years. Instructions on how to answer the questionnaire and how to tally the dosha scores were on the questionnaire. Participants were asked to complete and retain their dosha questionnaire prior to the informational session, which minimized any influence the informational session might have had on their selected answers. After the participants developed their dosha score, they were offered a handout that offers suggestions on how to use their dosha information. Those participants who evaluated themselves as a single dosha were asked to volunteer for the next phase, which was the determination of their human Apo E genotype.

**Study methods.** Volunteers who were identified as having single doshas were asked to provide their Apo E results from their doctor’s office or to supply a buccal swab genetic test sample. Sampling kits were provided by the testing lab, Salimetrics Labs. Each volunteer received an unopened testing kit to use for the sample collection. These kits included instructions for sample collection and handling following the testing. Participants reviewed and signed disclosure forms from both Salimetrics Labs and forms specific to this study prior to genetic sampling.
The samples were collected as quickly as possible and refrigerated in preparation for shipment to Salimetrics Labs. Each sample was coded with the participant’s study code. This coding enabled the Salimetrics Labs results to be compared to the dosha for each study participant and to be a tool to maintain confidentiality for all participants.

The study volunteers were divided into three groups according to their interpretation of their doshas: vata, pitta, and kapha. It was expected that the three groups would not be equal in number, but they would approximate 100 in each group for a total of 300 participants.

**Sampling Strengths and Weaknesses**

**Selection.** The major weakness of the study was that participant selection involved using a convenience sample. The total sample size was 319 participants.

**Self-administration.** Since the dosha questionnaire was self-administered, participants could have provided false answers if they chose to do so. This study assumed that participants would answer the questionnaire accurately and truthfully.

**Sample processing.** The buccal swab sample collection process, transportation to the lab, and lab processing all had potential failure exposure. The buccal swab could have been, or could have become, damaged or been exposed to contamination. Careful attention to the administrative process of proper labeling, completing paperwork, and attaching paperwork appropriately was essential for the entire study period.

**Measurements, Instruments, and Research Applications**

The experiment involved using mixed methodologies, including a quantitative questionnaire for dosha determination and a medical buccal lab test for human Apo E genotype determination. Written instructions for the completion of the questionnaire and the buccal lab test sampling were consistent for all participants.
Questionnaire Validity and Reliability

Using standardized questionnaires to establish Ayurveda dosha has been the subject of multiple research projects for the past 10 years. The interrater and intrarater reliability studies of Rastogi (2012) and others concluded that standardized questionnaires are superior to physician dosha evaluations. Several different standardized questionnaires are used around the world that reflect language, format needs, and cultural differences. All questionnaires rely on validity studies completed in India and referred to in the earlier sections of this study. The specific questionnaire selected for this study has been used by the Chopra Center with thousands of individuals. The Prakruti Dosha Mind Body Quiz (see Appendix A) is an American-friendly version of the Indian version.

Human Apo E Genotype Testing Validity and Reliability

Salimetrics Labs uses human Apo E genotype testing assays developed using Clinical and Laboratory Standards Institute (CLSI) guidelines. The CLSI guidelines are based on the reliability and validity studies established for genetic testing in the United States. Control DNA samples of known genotypes are tested together with each participant sample to ensure correct results. Salimetrics Labs possesses and maintains CLSI certification and monitoring.

Chapter Summary

This chapter provided the research methods used for the study to determine if a statistically significant relationship exists between the Ayurvedic tridoshas concept and the human genotyping Apo E in a sample size of 319 participants. The research conceptualization and operationalization addressed statistical methodology, as well as logistics and administration parameters, as part of the basis and completion of this research. The dosha questionnaire used in this study provided both validity and reliability, as outlined by Rastogi (2012). Rastogi focused
on meeting the need for quick, reliable dosha determination to complement the extensive ongoing Ayurveda and prakriti studies. According to Rastogi, “The concept of Prakriti has remained a subject of extensive exploration in the recent past. As a result, it is now better understood in terms of its genomic and biochemical correlations and subsequent clinical applications” (p. 209). Using commercial laboratories that specialize in human genotyping provided both validity and reliability for the Apo E testing. Nemoda et al. (2011) noted, “Recent studies reveal that high-quality and -quantity DNA can be obtained from saliva samples” (p. 2). In summary, the research methodology sufficiently addressed the question of statistical significance between the Ayurvedic tridosha concept and the human genotype Apo E.
Chapter 4: Research Results and Findings

Introduction

This study investigated whether a statistically significant relationship exists between the Ayurveda tridosha concept and the human genotype Apo E. The research hypotheses were as follows:

\[ H_0: \text{Ayurveda tridosha are independent of the human genotype Apo E.} \]

\[ H_A: \text{Ayurveda tridosha are not independent of the human genotype Apo E.} \]

This chapter includes an overview of the data collection, data analysis, and research findings, as well as the significance of the research findings and results.

Overview of Research Collection

Ayurvedic doshas questionnaires and saliva samples for testing the human genotype Apo E were collected from 319 participants between May 25, 2015, and August 19, 2015. All participants in this convenience sample were volunteers from professional conferences, informational sessions about Ayurveda, and doctors’ offices in Florida, Georgia, California, Virginia, and Canada.

The participants included residents from 31 states and 26 countries. Females comprised approximately 73% of the sample, and 26% of the participants were male, as shown in Figure 2. Approximately 1% of the participants did not respond (NP) to the gender question on the survey. Figure 3 displays the distribution of the participants’ ages, which ranged from 18 to 90 years. Nearly half of the participants were between 41 and 60 years old. Residency, gender, and age had no influence on the study variables. Participants’ demographic information is provided only as a demographic overview.
**Research Instruments and Process**

Participants completed a self-administered standardized questionnaire (see Appendix A). This questionnaire has been used by the well-known Ayurveda medical center Chopra Center in Carlsbad, California, and has been tested with thousands of individuals. Written instructions were provided on the questionnaire and given verbally by the researcher in most cases. The
questionnaires were either tallied by the participant and verified by the researcher or tallied by the researcher. Using the questionnaire results, dosha scores were known immediately. Participants whose scores identified them as single dosha were asked to volunteer for the next phase of determining their human Apo E genotype.

Participants with a single dosha were asked to review and agree to the Agreement to Participate in a Research Study and Authorization for Use and Disclosure of Information form (see Appendix C) and to provide their Apo E results either from their doctor’s office or from a buccal swab genetic test sample. Out of more than 2,200 individuals who completed the dosha questionnaire, only 319 had a single dosha and were willing to volunteer as a study participant.

Participants using a buccal swab were provided a numbered, unopened testing kit for saliva collection. The researcher wrote the same number on the saliva testing kit on the participant’s dosha questionnaire and release form. This number coding ensured confidentiality for the participant as well as data integrity of lab results compared to the dosha questionnaire results. Numbers were also assigned to participants whose Apo E results were supplied by their doctor’s office. Three hundred twelve samples were collected by buccal swab testing in the laboratory. Seven Apo E results were provided from the participants’ doctor’s office.

Ethical Considerations

The principles of informed consent and confidentiality as required by the Working Group on ELSI of the Human Genome Research were strictly adhered to in all aspects of this study. The Research Subject Agreement (see Appendix C) was prepared and administered to all participants as standard procedure in the data collection process. Informed consent and confidentiality were especially important for this study because it included the buccal swab test for saliva collection for genetic study for the human genetic marker Apo E. The testing laboratory Salimetrics
destroyed all samples after the lab work was completed and certified by Salimetrics specialists. Only the human genetic marker Apo E was analyzed by the laboratory.

The numbered coding system linking the saliva sample with the corresponding dosha questionnaire and the Research Subject Agreement (see Appendix C) systematically provided the integrity of the system while maintaining confidentiality for each participant.

Seven individuals completed the dosha questionnaire but decided not to participate in the study and did not provide their saliva sample. Three individuals completed the dosha questionnaire and decided to think about whether to participate. All three individuals returned the following day and participated in the study.

Collection of the buccal sample was simple for all the participants. Individuals placed the cotton collector in their mouth and removed it once it was saturated. Four participants dropped their cotton collector on the floor while removing it from their mouth. In all four cases, a new saliva testing kit was provided for the participant to start the saliva collection process over.

**Research Outcome Summaries**

**Dosha distribution.** All three ayurvedic doshas were represented in the sample of 319 participants. Figure 4 shows the distribution of the three doshas, with pitta represented by 61.9% of the participants, vata represented by 19.1%, and kapha represented by the remaining 18.8%. Although each dosha type was not represented equally, the sample size in both the kapha and the vata doshas provided sufficient representation. The pitta dosha was overrepresented. Given the personality tendencies of the pitta dosha, it was expected that pittas would volunteer more frequently than the other two doshas. Additionally, the pittas’ tendencies to be leaders in their professions added to a potentially higher number of pittas attending the conferences and Ayurveda information sessions where volunteers for this study were obtained. According to
Conte (2007), “Psychologically, pittas are focused, goal oriented and they live a purposeful life. . . [T]hey tend to make good leaders and orators. They prefer noble professions, such as doctors, lawyers, judges, politicians, and engineers” (p. 61). The overrepresentation of pittas in the sample is addressed in the final statistical analysis of this study in Figure 5. By using expected frequencies of Apo E as well as expected frequencies of each dosha category for the final analysis, this overrepresentation of pitta dosha is addressed.

Figure 4. Distribution of the dosha across all participants.

**Apo E distribution.** Figure 5 graphically displays the Apo E results for all 319 study participants. Apo E 2/2 appeared in two participants (0.6%), Apo E 2/3 appeared in 32 participants (10.0%), Apo E 2/4 appeared in three participants (0.9%), Apo E 3/3 appeared in 182 participants (57.1%), Apo E 3/4 appeared in 88 participants (27.6 %), and Apo E 4/4 appeared in 12 participants (3.8%).
Figure 5. Distribution of the Apo E across all participants.

The percentage of Apo E found in the general human population is as follows: “Apo E 2/2-1%, 2/3-10%, 3/3-64%, 4/2-2.0%, 3/4-18%, 4/4-5%” (McDonald, 2010, p. 10). A comparison between the Apo E distribution found in the general human population and the study participants is shown in Figure 6. The study participants were largely in line with the general human population, with the e3/e4 group overrepresented. A chi-square goodness-of-fit test performed on the participants’ Apo E distribution compared to the general population distribution yielded a chi-square statistic of 21.46, with 4 degrees of freedom and a $p$ value of .000257. This highly significant result indicates that the participants’ Apo E distribution is significantly different from the general population, almost entirely due to the overrepresentation of the e3/e4 group. To address this overrepresentation of the e3/e4 Apo E in the study sample compared to the general human population, the chi-square contingency table analysis shown in Table 2 addresses this study sample outcome. By comparing one sample variable distribution to the other sample variable distribution, researchers are able to consider study samples appropriately in the final analysis.
Figure 6. Distribution of the participants’ Apo E versus the general population’s Apo E.

Significance of results and findings. The research hypothesis stated that there is a statistically significant relationship between primary Ayurveda doshas and human genotype Apo E that could be used to develop new preventative and treatment approaches for certain medical conditions. Formally, the hypotheses were as follows:

H₀: Ayurveda tridosha are independent of the human genotype Apo E.

Hₐ: Ayurveda tridosha are not independent of the human genotype Apo E.

For the categorical variables of Ayurveda tridosha and Apo E, the hypothesis was tested using a chi-square contingency table analysis. Table 3 shows the observed values based on the participants’ quiz responses and corresponding Apo E testing. In Table 2, the number of participants in each dosha and collectively is set as the marginal totals to be compared to expected frequencies of the variable Apo E. Table 2 also shows the expected values under the null hypothesis (H₀) of independence.
Table 2

Apo E Categories of Expected Frequencies

<table>
<thead>
<tr>
<th>Dosha</th>
<th>e2/e2</th>
<th>e2/e3</th>
<th>e2/e4</th>
<th>e3/e3</th>
<th>e3/e4</th>
<th>e4/e4</th>
<th>Marginal Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kapha</td>
<td>0.36</td>
<td>6.02</td>
<td>0.56</td>
<td>34.23</td>
<td>16.55</td>
<td>2.26</td>
<td>60</td>
</tr>
<tr>
<td>Pitta</td>
<td>1.24</td>
<td>19.86</td>
<td>1.86</td>
<td>112.97</td>
<td>54.62</td>
<td>7.45</td>
<td>198</td>
</tr>
<tr>
<td>Vata</td>
<td>0.36</td>
<td>6.12</td>
<td>0.57</td>
<td>34.80</td>
<td>16.83</td>
<td>2.29</td>
<td>61</td>
</tr>
<tr>
<td>Marginal Totals</td>
<td>2</td>
<td>32</td>
<td>3</td>
<td>182</td>
<td>88</td>
<td>12</td>
<td>319</td>
</tr>
</tbody>
</table>

Table 3

Apo E Categories of Observed Frequencies

<table>
<thead>
<tr>
<th>Dosha</th>
<th>e2/e2</th>
<th>e2/e3</th>
<th>e2/e4</th>
<th>e3/e3</th>
<th>e3/e4</th>
<th>e4/e4</th>
<th>Marginal Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kapha</td>
<td>7</td>
<td>1</td>
<td>33</td>
<td>15</td>
<td>4</td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>Pitta</td>
<td>1</td>
<td>21</td>
<td>2</td>
<td>113</td>
<td>56</td>
<td>5</td>
<td>198</td>
</tr>
<tr>
<td>Vata</td>
<td>1</td>
<td>4</td>
<td>36</td>
<td>17</td>
<td>3</td>
<td></td>
<td>61</td>
</tr>
<tr>
<td>Marginal Totals</td>
<td>2</td>
<td>32</td>
<td>3</td>
<td>182</td>
<td>88</td>
<td>12</td>
<td>319</td>
</tr>
</tbody>
</table>

Apo E categories e2/e2 and e2/e4 each have marginal totals of only 2 and 3, respectively.

To avoid violating the conditions for performing the chi-square test of independence, the e2/e2 and e2/e4 columns were eliminated from the observed and expected tables when conducting the chi-square test. The chi-square test for independence yielded a chi-square value of 3.596, with 6 degrees of freedom and a $p$ value of .731. Given the large $p$ value (.731), the null hypothesis of independence between the primary dosha and the Apo E is accepted. That is, the research data from 319 participants (314 used for the chi-square test) did not support the research hypothesis that a statistically significant relationship exists between Ayurveda tridoshas and Apo E at any reasonable level of statistical significance.

Chapter Summary

There was no statistical significance in the relationship between the Ayurvedic doshas and the human genetic marker Apo E. Hence, the results did not provide sufficient evidence to
support the hypothesis that a statistically significant relationship exists between the Ayurveda tridosha concept and the human genotype Apo E.

Conclusions about this study, including a summary of the findings, findings for the hypothesis test, and findings relative to prior studies, are presented in Chapter 5. The chapter also includes implications of the study and future recommendations for additional research.
Chapter 5: Conclusions, Implications, and Recommendations

Introduction

This chapter includes the findings of the study in a coherent overview of the research study questions, methodology, and conclusions. The conclusions include a summary of the findings, findings for the hypothesis test, and findings related to prior studies, as well as implications of the findings and future recommendations.

Research Study Questions and Hypothesis

The core of the problem. This study sought to determine if a statistically significant relationship exists between the Ayurveda tridosha concept and the human genotype Apo E. The research hypothesis of this study was that the Ayurveda tridosha is not independent of the human genotype Apo E.

Methodology supporting this research. The population for this study could include all humans, as every human has both variables: an Ayurveda dosha and an Apo E human gene. A sample of 319 volunteers participated. These adult participants included both genders and were ages 18 to 90. Participants’ residences included 31 states and 26 countries. The diversity of participants supported the design of the research to obtain a broad-based, representative sample.

All participants completed the Ayurveda dosha questionnaire (see Appendix A). Of the 2,200 volunteers who took the dosha questionnaire, only 319 established themselves as having a single primary dosha. Three hundred twelve participants provided their human genotype Apo E by a buccal swab and seven participants provided their genotype Apo E from their doctor’s office.
Conclusions

**Summary of findings from this research.** All three doshas were sufficiently represented in the research sample of 319 participants, as were all six of the human genotypes for Apo E. The distribution of the participants’ Apo E genotypes was largely consistent with the general population, with the exception that e3/e4 was overrepresented by about 52%. However, no significant statistical relationship between the single Ayurveda doshas and the human genotype Apo E was found with this sample.

**Findings for the hypotheses test.** A chi-square contingency table analysis was conducted to test the research hypotheses:

- $H_0$: Ayurveda tridosha are independent of the human genotype Apo E.
- $H_A$: Ayurveda tridosha are not independent of the human genotype Apo E.

The chi-square test statistic was 3.596, with 6 degrees of freedom, and a $p$ value of .731. The results of this test concluded that the null hypothesis, $H_0$, could not be rejected, and therefore, the data did not support the research hypothesis that a statistically significant relationship exists between the Ayurveda tridosha and the human genotype Apo E.

**Findings relative to prior studies.** The findings of the literature survey in Chapter 2 showed no previous research involving the same variables of the Ayurveda primary single dosha and the human genotype Apo E. However, the literature survey revealed a broad range of research involving both Ayurveda doshas and the human genotype Apo E considered individually rather than in tandem. Examples of topics with research centered on Ayurveda single primary doshas range from topics with specific concerns such as platelet aggregation (Bhalerao et al., 2012) to the much broader topic of using Ayurveda diagnostic criteria in Ayurveda clinical trials (Brar et al., 2012) as well as heart disease (Mahalle et al., 2012).
notable type of study centered on applying Ayurveda doshas and Ayurveda knowledge to maximize disease prevention included possibilities of newborn screening to customize a lifetime disease prevention plan (Dey & Pahwa, 2014) as well as research on the tridosha concept lifestyle recommendations to patterns of aging (Purvy & Meena, 2011). The human genotype Apo E has been attached to a wide range of research, including dietary guidelines (Arab, 2004; Erkkila et al., 2001), longevity (Frisoni, 2001), and brain development (Growdon, 2014), as well as Alzheimer’s disease (Heidenreich, 1998) and coronary artery disease (Humphries et al., 2004).

Research involving Ayurveda doshas and human genotypes other than Apo E was abundant. A notable example of the Ayurveda tridoshas concept applied to specific human genomarkers was “HLA Gene With a Reasonable Correlation Between HLA and Prakriti (Doshas) Type” by Bhushan et al., 2005). A study that presented immediate usable observations involved the study of Ayurveda doshas compared to the human genetic marker CYP2C19, where a correlation was drawn to illustrate the speed with which individuals responded to drug interactions based on their dosha type (Ghodke et al., 2011).

This study appears to be the first research study involving the two specific variables primary Ayurveda doshas and human genotype Apo E. Therefore, this study adds to the literature on the relationship between Ayurveda and human genetics.

Potential bias and limitation of the study. A large percentage (62.1%) of the study participants were classified with the pitta primary dosha. Only 19.1% were vata and 18.8% were kapha. A more equitable distribution of the primary doshas may have yielded a different result, as Ayurveda practitioners expect equal distribution of all three doshas and subdoshas within the general population.
A large percentage (73.0%) of the participants were female, and only 26% were male. A more equitable distribution of the genders may have yielded a different result. The scientific community operates with the understanding that the human genotype Apo E and the Ayurveda tridosha are spread across humanity without regard to gender.

The majority of study participants were selected from several groups of conference attendees. A more broadly diversified selection of participants may have yielded a different result. In addition, whereas the sample participants represented a broad diversity of residency from 31 states and 26 countries, 92% of the participants were from Western countries or regions of the world. The study results may have been different if the participants’ residency was concentrated in other geographical regions or non-Western countries.

Even with 319 study participants, there were only two samples with e2/2 Apo E, only three with e2/4 Apo E, and 12 with e4/4 Apo E. These results were expected due to the normal occurrence of Apo E in the human population. The percentage of Apo E found in the general human population is “Apo E 2/2-1%, 2/3- 10%, 3/3-64%, 4/2-2.0%, 3/4-18%, 4/4-5%” (McDonald, 2010, p. 10). A different result may have occurred with a substantially larger sample size.

**Implications of the findings.** Despite finding that the data did not support the research hypothesis of this study, researchers will recognize the significance of the question in the hypothesis. In the context of broad research involving Ayurveda and human genetics, this study adds to the body of knowledge with its specific subject matter. Additionally, the credibility of possible relationships between Ayurveda and genetics is expanded with the simplicity of using the tridosha questionnaire coupled with the frequently used buccal swab human genotype testing method.
Modern science and Western medicine have made many remarkable discoveries and advances such as antibiotics, vaccines, and technological breakthroughs such as x-rays. The benefits of these discoveries and advances continue to affect humankind positively. An example is the extension of the average human life span from approximately 40 years of age in the 1890s to the mid to late 70s in the 21st century. However, Western medicine seeks treatment for the symptoms when faced with the onset of disease, whereas Ayurveda rests on the foundation of disease prevention by means of customized lifestyle choices designed to maintain self-regulation for each individual’s unique constitution, or dosha. Human health care provides more benefits to patients by blending Western medicine treatments and Ayurveda’s approach to disease prevention with lifestyle choices. Every research study that demonstrates the viability of this blend brings credibility to both medical systems. Conte (2007) noted, “Hence, both the holistic approach and modern medicine practices are equally important in the diagnosis and treatment of disease in modern day society” (p. 12).

**Recommendations for future research.** The parallels and similarities between the ancient Ayurveda medical system and Western medicine grow more apparent every day. These parallels emerge through the increased research on the two systems as well as from medical care providers who draw from both practices. The expansion of knowledge about human genetics and Ayurveda continues to evolve separately as well as in relationship to each other. Western medicine is currently at a crossroads regarding the question of fixed genetic determination, which refers to the paradigm that every gene is coded and fixed, compared to more current research in epigenetics. For more than 50 years, the general public and the scientific community have embraced genetic explanations for what defines and shapes each individual. Epigenetics research has advanced the understanding that human genes are not fixed, but instead are
expressed in varying ways depending upon the circumstances. The study of epigenetics has given rise to a new approach to genetic therapy. However, the question of genetic determination versus varying genetic expression is still unresolved for the medical community and thus the public. Church (2009) noted, “This picture of a genetic makeup that fluctuates by the hours and minute is at odds with the picture ingrained in the public mind that genetics determine everything about our physical characteristics to our behavior” (pp. 30-31).

With the completion and publication of the mapping of the human genome in April 2003 by the Human Genome Project, many had hoped for the simplicity of establishing the specific role of each human gene. This fixed gene definition was initially pursued as the basis of genetic therapy but has proven to be insufficient to address the complexity of the human experience. Even with the significant research on the statistical connection of the human genotype Apo E to Alzheimer’s disease and coronary artery disease, medical recommendations about this information have not changed the statistical outcome of the occurrences of both these diseases. Insurance companies limit authorization for genetic testing, as the Western medical community does not have proven standardized protocols to use genetic testing information in a meaningful way. According to the National Human Genome Research Institute (2005), “Often, the informational materials distributed by academic and commercial genetic testing laboratories do not provide sufficient information to fill in gaps in providers’ and patients’ understanding of genetic tests” (p. 5). Given that current genetic research demonstrates a relationship exists between Apo E and coronary artery disease and Alzheimer’s disease, the results of future studies could indicate why some individuals present these diseases and others do not. Using the Ayurveda preventive lifestyle practices in conjunction with Western medical genotyping could mitigate the occurrence of both Alzheimer’s disease and coronary artery disease. Favorable
results of future studies could influence insurance companies to reconsider paying for genetic testing.

To support the expanding connection between Western medicine and Ayurveda further, the hypotheses of this research could be repeated with a larger sample size with greater equity between gender and the Ayurveda tridoshas. Additionally, greater geographic diversity in the repeated study could also provide different outcomes.

This study demonstrated the ease with which Ayurveda doshas could be determined in group settings, as well as one-on-one research. With the simplicity of administrating the dosha questionnaire, researchers could easily and inexpensively add the Ayurveda tridoshas variable to any research study involving human genetics, which could expand to include not only the Apo E genetic marker, but also other genotype or combination of genotypes in other studies. Adding the Ayurveda tridosha variable to future research would accelerate the knowledge of both Ayurveda and Western medicine.

Looking beyond addressing the simple replication of this study on a larger scale and attaching Ayurveda tridoshas as a variable to other studies, another conclusion and possible avenue of research from this study is the obvious manner in which the primary doshas are distributed uniformly across the human genetic marker Apo E and in a similar manner as Apo E is found across the human populations. When comparing the data in Tables 2 and 3, the data in Table 3 demonstrate that in the sample of 319 participants, the dosha distribution closely tracks with the expected distribution of Apo E across the total human population.

**Implications for Ayurveda and coronary artery disease research.** Ayurveda practice recommends unique diet, exercise, and other lifestyle choices for each dosha as the basis for preventing disease. In contrast, Western medicine offers limited suggestions for disease
prevention based on certain Apo E allele determination. To confound the Apo E research findings, Western medicine does not offer an explanation of why some individuals with an Apo E marker known to have a statistical link to coronary artery disease actually present with the disease, whereas others never present within their lifetime. To complicate the interaction between the patient and the doctor further, limited information has been disseminated regarding which Apo E alleles are statistically linked to any disease. This study did not report Apo E’s except in group totals to protect the integrity of the individual study participants. Another study to determine any relationship between Ayurveda doshas and coronary artery disease would offer a possible explanation of the close link between coronary artery disease and dosha type and dosha balancing. This study would go beyond establishing the primary dosha for the participants and would establish whether all participants maintained a balance in their dosha during their lifetime or not. The Ayurveda medical system maintained that unbalanced doshas lead to disease while balanced doshas maintain good health. By identifying a known population of coronary artery disease patients, a study can be formed around establishing their dosha type and their lifestyle choices to determine if the Ayurveda position of dosha imbalance shows a statistical link to their coronary artery disease. Lifestyle patterns found in the coronary artery disease study participants could provide a roadmap toward priorities of implementing specific Ayurvedic practices to a broader population of individuals interested in coronary artery disease prevention.

**Emergent themes.** The literature review of this study revealed there were no previous studies involving the specific variables of the Ayurveda tridosha concept and the human genotype Apo E. Therefore, for this research, there were no data with which to link. Knowing there were no data to draw from, the researcher undertook limited observation in interfacing with the more than 2,200 individuals interviewed for the study. Being as unbiased and neutral as
possible, the researcher noted three questions and concerns arising from an overwhelming majority of the interview interactions. Most individuals expressed a desire to know what foods to eat and what exercise programs would work for them. They expressed that the information available to the public was confusing and did not work for them. Further, more than half of all individuals interviewed had not heard of Ayurveda, whereas seemingly more than 90% had not heard of the human genotype Apo E. Without exception, everyone interviewed was interested in learning more about both variables. This research increased public awareness of both Ayurveda and human genetics.

**Conclusion.** Although the findings from this study did not show a statistically significant relationship between the Ayurveda tridosha concept and the human genotype Apo E, this study is another important contribution to the body of scientific knowledge about both human genetics and the Ayurveda medical system. Both Western medicine and Ayurveda continue to evolve individually and in parallel in the search for ways to heal the diseases that humankind experiences around the world. Further studies centered on the most significant human diseases such as coronary artery disease and Alzheimer’s disease that include the age-old wisdom of Ayurveda could bring more choices to individuals seeking prevention techniques for these conditions. Further insights into the mystery of why one individual presents with disease and another does not, given similar circumstances, may become more apparent. Both Western medicine and Ayurveda have much to offer to humankind.
References


associated with the metabolic variability. Evidence-Based Complementary and Alternative Medicine, 2011. doi:10.1093/ecam/nep206


doi:10.1097/01.GIM0000079364.98257.26

doi:10.1021/cb2003016


Appendix A: Prakruti Dosha Mind Body Quiz

**NAME:** ___________________________________________ **DATE:** ________________________________

This mind-body questionnaire gathers information about your basic nature – the way you were as a child or the basic patterns that have been true most of your life. If you developed an illness in childhood or as an adult, think of how things were for you before that illness.

**INSTRUCTIONS:** (Please read carefully!) **Rank each characteristic with 5, 3, or 1.** For each row, use each number one time. (Each row should add up to 9.)

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>VATA</th>
<th>PITTA</th>
<th>KAPHA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FRAME</strong></td>
<td>I am thin, lanky and slender with prominent joints and thin muscles.</td>
<td>I have a medium, symmetrical build with good muscle development.</td>
<td>I have a large, round or stocky build. My frame is broad, stout or thick.</td>
</tr>
<tr>
<td><strong>WEIGHT</strong></td>
<td>LOW; I may forget to eat or have a tendency to lose weight.</td>
<td>MODERATE; it is easy for me to gain or lose weight if I put my mind to it.</td>
<td>HEAVY; I gain weight easily and have difficulty losing it.</td>
</tr>
<tr>
<td><strong>EYES</strong></td>
<td>My eyes are small and active.</td>
<td>I have a penetrating gaze.</td>
<td>I have large pleasant eyes.</td>
</tr>
<tr>
<td><strong>COMPLEXION</strong></td>
<td>My skin is dry, rough or thin.</td>
<td>My skin is warm, reddish in color and prone to irritation.</td>
<td>My skin is thick, moist and smooth.</td>
</tr>
<tr>
<td><strong>HAIR</strong></td>
<td>My hair is dry, brittle or frizzy.</td>
<td>My hair is fine with a tendency towards early thinning or graying.</td>
<td>I have abundant, thick and oily hair.</td>
</tr>
<tr>
<td><strong>JOINTS</strong></td>
<td>My joints are thin and prominent and have a tendency to crack.</td>
<td>My joints are loose and flexible.</td>
<td>My joints are large, well knit and padded.</td>
</tr>
<tr>
<td><strong>SLEEP PATTERN</strong></td>
<td>I am a light sleeper with a tendency to awaken easily.</td>
<td>I am a moderately sound sleeper, needing less than eight hours to feel rested.</td>
<td>My sleep is deep and long. I tend to awaken slowly in the morning.</td>
</tr>
<tr>
<td><strong>BODY TEMPERATURE</strong></td>
<td>My hands and feet are usually cold and I prefer warm environments.</td>
<td>I am usually warm, regardless of the season, &amp; prefer cooler environments.</td>
<td>I am adaptable to most temperatures but do not like cold, wet days.</td>
</tr>
<tr>
<td>TEMPERAMENT</td>
<td>I am lively and enthusiastic by nature, I like to change.</td>
<td>I am purposeful and intense. I like to convince.</td>
<td>I am easy going and accepting. I like to support.</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>UNDER STRESS...</td>
<td>I become anxious and/or worried.</td>
<td>I become irritable and/or aggressive.</td>
<td>I become withdrawn and/or reclusive.</td>
</tr>
<tr>
<td>TOTAL</td>
<td>_____ VATA TOTAL</td>
<td>_____ PITTA TOTAL</td>
<td>_____ KAPHA TOTAL</td>
</tr>
</tbody>
</table>

Note: Each row should add up to 9. VATA TOTAL, PITTA TOTAL, and KAPHA TOTAL should add up to 90.

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PERSONAL INFORMATION

NAME: ________________________________

DATE OF BIRTH: ________________________________

LOCATION OF BIRTH (CITY & STATE): ________________________________

MALE   FEMALE

ADDRESS: ________________________________

_______________________________

EMAIL ADDRESS: ________________________________

PHONE: ____________________________ TYPE: HOME  CELL  OFFICE

AGE: __________________

HEIGHT: __________________

WEIGHT: __________________

EYE COLOR: ____________

HAIR COLOR: ____________

BLOOD TYPE: ____________

Would you like a copy of the finished research document emailed to you when the project is completed?

YES   NO

SIGNATURE: ________________________________ DATE: ____________________
Appendix B: Salimetrics Sample Cortisol Results

Date: 06/09/08  
Investigator:  
Customer ID: 4444  
Study: stress

Cortisol results

<table>
<thead>
<tr>
<th>Salimetrics ID</th>
<th>Sample ID</th>
<th>Result 1</th>
<th>Result 2</th>
<th>Mean (ug/dL)</th>
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Mary Curran  
Technical Supervisor
Appendix C: Research Subject Agreement

Agreement to Participate in a Research Study
And Authorization for Use and Disclosure of Information

Research Project

An investigation of whether a statistically significantly relationship exists between the Ayurveda doshas and the human genetic marker, Apo E, with the possibility of identifying a new synergistic connection with complementary and alternative medicine and traditional Western allopathic medicine to help foster an integrative medicine approach to health care.

You are being asked to take part in a research study (the “Study”). Under the rules governing human research subjects, I will first explain the Study, and then I will ask you if you would like to participate. If you decide to participate in the Study, I will ask you to sign this Agreement which states that the Study has been explained, that your questions have been answered, and that you agree to participate.

I will explain the purpose of the Study and how the Study will be carried out and what you will be expected to do. I will also explain the possible risks and benefits of being in the Study. You should ask me any questions you have about any of these things before you decide whether or not you wish to take part in the Study.

Please read this Agreement carefully and talk to me about any questions you may have. Then, if you decide to be in the Study, please sign and date this Agreement and return it to me. You will be given a copy of this Agreement to keep.

1. Nature and Purpose of the Project

The nature of this Study includes two components. One component is based on India’s ancient health care tradition called Ayurveda. Ayurveda uses a unique classification system based on an individual’s nature which becomes the basis of a personalized medical approach. According to Ayurveda there are three primary groupings or doshas, identified as pitta, kapha, and vata. The second component is based on the Human Genome Project which has provided the basis for expanded research on genotyping or human genetic markers. In particular, the Study looks at the genotype called Apo E which has been researched in regards to particular diseases.

You are being asked to take part in the Study because the information obtained will assist in determining if there is any statistically significant relationship between Ayurveda doshas and the human genetic marker Apo E in the participants in the Study. The Study is designed to evaluate 300 research subjects. If research from the Study demonstrates that a statically significant relationship exists between the Ayurveda doshas and the human genetic marker, Apo E of the participants, then a new synergistic connection may have been created between these two medical approaches. A greater symbiotic relationship between Western medicine and ancient Ayurveda could fundamentally change healthcare as it exists today. Evidence of a statistically significant relationship between Ayurveda doshas and human genotype Apo E could present new approaches of integration of Ayurveda and conventional Western medicine for both the treatment and prevention of related medical conditions.

Medical care systems are evolving around the world to address a growing need for health care in the world’s population. One such evolution is in the area of Integrative Medicine whereby conventional Western medicine is combined with alternative or complementary treatments such as Ayurveda, yoga, and meditation, among others. This Study is part of my PhD program in Integrative Health at Energy
Medicine University and is designed to expand the ways that alternative and complementary treatments are blended with Western medicine.

2. **Explanation of Procedures**

If you take part in the Study, you will be asked to do two things as follows:

1. Complete the Dosha Questionnaire used by the Chopra Center, Carlsbad, California, which will provide you and me with your dosha assessment. You will be asked to complete the questionnaire prior to the informational session regarding the Study. This will minimize any influence the information session might have on your selected answers to the questionnaire. The questionnaire will take less than 30 minutes for you to complete. It will be essential for you to answer the questions on the questionnaire truthfully. Once you have developed your dosha score, you will be provided with handouts that offer suggestions on how you can utilize your dosha information. If the assessment indicates you rank with a single dosha, you will be asked to volunteer for the next phase of the Study which is to determine your human Apo E genotype.

2. If you are asked to provide your Apo E sample, you have two options. One is to provide a saliva sample with a swab for collecting information regarding your Apo E genetic information. The saliva swab is the most common method used for Apo E stand-alone research. This test is non-invasive and meets the National Human Genome Research Institute’s standards. A saliva swab collects DNA from the cells of the inside of your cheek using a swab or sponge-like device. If you choose this option, I will provide you with a sampling kit from the testing lab, Salimetrics Labs. This kit includes instructions for sample collection and handling following the testing. You will be asked to sign this Agreement and Salimetrics Labs disclosure form prior to collecting your Apo E genetic sample. Once this has been done, I will collect your testing kit directly from you.

The second option is for you to obtain your Apo E genetic sample directly from your medical doctor which requires a blood test. If you chose this option, you agree to sign a release form from your doctor allowing him/her to release the information regarding you Apo E genetic information obtained in the blood test to me for purposes of the Study.

As the investigator of the Study, if you have any questions or concerns regarding the procedures for the Study, please contact me at 813-719-0201.

3. **Discomforts and Risks.**

The Chopra Center’s Dosha Questionnaire is a standardized instrument and poses no known risks. The saliva swab for collecting Apo E genetic information is non-invasive and poses no known risks. The blood test for collecting Apo E genetic information can cause discomfort and anxiety in some people.

4. **Benefits**

As a volunteer in the Study, I hope that you will receive the benefit of learning about your dosha and the basic information about the Ayurveda system of health care. In terms of the benefits to society as a whole, I hope to demonstrate a way to expand and move forward the field of Integrative Medicine by demonstrating how it is possible for alternative and complementary treatments to be blended with Western medicine.
5. **Confidentiality**

The section at the end of this Agreement called “Research Authorization for Use and Disclosure of Information” provides detailed information about how the information learned about you during the Study will be used and shared. More generally, all of your records from the Study will be treated as private health care records. While I am not a health care provider, I choose to have my privacy practices and policies follow the protection of private health care information rules in the Federal Health Insurance Portability and Accountability Act of 1996 and its regulations (“HIPAA”).

While the results of the Study will probably be shared with other people such as my dissertation committee and will be published in my dissertation for a PhD in Integrative Health through Energy Medicine University, your name and the fact that you were in the study will be kept confidential.

6. **Refusal/Withdrawal**

Your participation in the Study is strictly voluntary and you alone decide whether or not you want to be in the Study. If you decide to participate in the Study, you can change your mind later and quit the Study.

7. **Research Authorization for Use and Disclosure of Information.**

The purpose of this section of this Agreement is to provide you with some more information about how the information learned about you during the Study will be used and shared.

I understand that your medical information is very personal and I will work hard to keep it private. IF YOU SIGN THIS FORM YOU CONSENT TO PARTICIPATE IN THE STUDY AND ARE GIVING ME PERMISSION TO USE AND SHARE YOUR PERSONAL HEALTH INFORMATION IN THE WAYS DESCRIBED IN THIS AGREEMENT.

**Understandings and Notifications**

The main purpose of permitting the use and release of your information is to allow the Study to be conducted and to ensure that the information relating to the research collected in the Study is available to all parties who may need it. All health care providers are required to protect the privacy of your information. However, most persons or entities (i.e., businesses, organizations) that are not health care providers are not bound by law to protect the privacy of your information. You understand that if the person or entity that receives your information is not a health care provider bound to protect your privacy, such person or entity might re-release your health information.

You have the right to refuse to sign this Agreement. If you do not sign this Agreement, you will not be able to enroll in the Study.

If you sign this Agreement, you may withdraw from the Study at any time. However, if you do not want me and others involved in the Study to use or disclose any further information in the Study you must cancel your permission in writing. If you cancel your permission, you will stop taking part in the Study and no new information will be collected about you. However, if you cancel your permission, it will not apply to actions already taken or information already collected about you by me before you canceled your permission. This information or action may be needed to complete analysis and reports of the Study. This permission will never expire unless you cancel it. To cancel this permission, please write to Jennifer Closshey, 2111 N. Golfview Drive, Plant City, FL 33566.
If after you have signed this form you have any questions relating to your rights, please contact Jennifer Closshey, Principal Investigator/Researcher at 813-719-0201 or jclosshe@me.com.

SIGNATURES

I have read and understand this Agreement. **ALL OF MY QUESTIONS HAVE BEEN SATISFACTORILY ANSWERED, AND I WANT TO TAKE PART IN THE STUDY.**

By signing below, I give my permission to participate in the Study and for the described uses and releases of information

___________________________  __________________________
Signature of Study Volunteer   Date

I ASSURE THAT I HAVE FULLY EXPLAINED TO THE ABOVE STUDY VOLUNTEER, THE NATURE AND PURPOSE, PROCEDURES AND THE POSSIBLE RISK AND POTENTIAL BENEFITS OF THIS RESEARCH STUDY.

___________________________  __________________________
Jennifer Closshey  Date
Principal Investigator/Researcher