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An Analysis of Factors Related to Time-Dependent vs. Acquired Aging in Males

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(Athletic Administration Teacher Certification)

By

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Department of Kinesiology, Sports Studies, and Physical Education

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Abstract

The purpose of this synthesis was to determine which factors impact, slow down, or even halt certain aspects of the natural aging process in males. Initial review of the topic included an examination of the aging theories found in the literature. The subsequent focus of this synthesis was on a critical mass of data based literature relating to the signs and symptoms of the aging processes. Next, the critical mass was synthesized to determine the most prominent findings in the published research regarding the slowing of the aging process in both the physical and cognitive domains. This included studies about the effects of physical activity, nutrition, supplementation, and cosmetic care to examine the potential impact these variables have on males as they grow older. Data for this synthesis came from studies examined in both published literature and thesis collections. The results from the critical mass of literature demonstrated that evidence exists supporting the notion that people can slow the aging process with proper physical activity, nutrition, supplementation, and cosmetic care. Disease and disability were once considered an inevitable part of growing older, but that is no longer true. While aging does put us at greater risk for health issues, many older adults can be healthy and active well into their advancing years. Currently, the average active life expectancy for the ADL is 68.4 years for males in the United States. It was determined that with an evolving regimen of proper exercise, nutrition, supplementation, and cosmetic care an individual can successfully delay the acquired effects of aging.

CHAPTER 1

INTRODUCTION

Aging is a natural process that individuals from all walks of life have been trying to defy using all scientific and spiritual avenues throughout the ages. In order to defy, beat, or halt the aging process, aging itself must be understood completely. Before we begin it is important to understand that the biological processes of aging cannot be stopped all together; they are inevitable. These processes include the overall changes in body composition, skin elasticity, aerobic capacity, cognitive function, and eventually death. There are several theories of aging that are going to be examined in order to better understand the aging process that we experience. None have been proven to be the sole cause of aging and in the opinion of many, a combination of all the aging theories lead to this process.

Background

According Gilchrest (1984), there are six theories behind biological aging all with scientific standing in our community. The first of which is the DNA replication theory which states that random errors occur in the DNA replication process; aging occurs from gradual accumulations of such errors, with eventual functional or reproduction death of individual cells (Gilchrest, 1984). The build-up of these erroneous cells, in theory, would lead to mutations in the body such as loss of muscle mass and bone density to name a few. Furthermore, the accumulation of mutations and death to individual cells would lead up to the natural death process of the multi-organ system.

The second aging theory is known as Orgel's Error Theory states that errors in the reproduction of DNA into RNA are common (Gilchrest, 1984). These common errors, although small in nature, begin to accumulate over time and compromise the function of the cells and the

body as a whole. In other words, once a multitude of cells are compromised the aging process begins and eventually natural death follows with the compromising of too many cells.

Another theory known as the Cross-Linkage Theory essentially states that collagen fibers (our structural proteins for major organs) become increasingly cross-linked with age. Cross-linking simply means the collagen fibers become less elastic and efficient with time. Essentially they degenerate as an individual ages. Moreover, the degeneration of our base substance (collagen fibers) in major organs leads to decreased efficiency of our bodily functions leading to the aging process as we know it (Gilchrest, 1984).

A fourth and widely published theory is the Free Radical Theory that states that free radicals are the main proponent of aging. Free radicals are essentially extra electrons that break free from the atoms inside our body and collide with other atoms at the molecular level. These collisions cause damage at the subatomic level and over time they wear down the body and create the aging process as we know it. Factors like over exposure to sunlight as well as other harmful biological agents such as drugs and alcohol can speed up the process; whereas proper antioxidant nutritional supplementation may help defend against this. According to Gilchrest (1984), our body has some natural defense systems in place, most notably the enzyme superoxide dismutase, whose levels tend to decrease with the age of an organism.

The fifth and sixth theories of aging utilize the body's ability to age on its own via a "pacemaker." One generally accepted theory on aging is the Pacemaker or Endocrine Theory, which states that aging is controlled by a pacemaker such as the thymus, hypothalamus, pituitary or thyroid gland (Gilchrest, 1984). In other words, a single organ may control the aging process for humans and it does so by secreting a sort of aging hormone at a certain point in a person's

life. Finally, some believe that aging occurs due to the pacemaker effect, specifically from the T lymphocytes that are secreted by the thymus. This theory states that T lymphocytes are solely responsible for the aging process in humans and is known as the Immunological Theory.

No matter what theory is supported by scientists some universal truths about aging have been documented, and are widely regarded as fact. The ones this synthesis will focus on are the depletion of muscle mass and bone density (body composition), loss of aerobic capacity, loss of cognitive function, and loss of skin elasticity as people grow older. After looking at all of these factors in the introduction and identifying certain facts about each one we will better be able to understand them individually and as a whole. Next, we will look at the most current research in the fields of fitness, nutrition and supplementation, and cosmetics to see what, if anything, we can do to slow or halt the aging process.

Body composition in the form of muscle mass is the first factor we will investigate when considering the aging process. There is no doubt people's physiques change over time and much of this has to do with a change in body composition. In other words, muscle depletes over time while fat accumulates. The technical term for depleting muscle associated with aging is sarcopenia; so let's see how sarcopenia affects the modern male. Research evidence suggests that the average male will lose muscle mass every year after the age of 25 at the rate of 0.5% (Chatterjee, 2012). This number doubles at age 60 when inactive males begin to lose 1% per year and after the age of 70 when males begin to lose 2% per year (Chatterjee, 2012). This means that if left inactive, the male body will undergo around a 30% decrease is muscle mass by age 70. However, this is a relativity conservative estimate. In 1993, Rogers and Evans found that "the muscular system undergoes a 40% loss of muscle mass and 30% decrease in strength by age 70"

as cited in McCraken (2009). It is the goal of this synthesis to determine whether or not the depletion of muscle mass and strength can be halted via interventions.

The body as whole undergoes a change in body composition due in large part to sarcopenia; in other words as we age we lose muscle mass and gain body fat. Research suggests that males lose muscle mass at different rates depending on the location of the muscle and the age of the individual (MEDLINE Plus, 2012). In conclusion, when all things are left alone, muscle mass not only depletes as a male gets older buts starts depleting faster the older we get, which creates an inevitable snowball effect.

Bone density loss limits what the elderly can do in their daily lives. Perhaps there are some steps that can be taken along with physical fitness steps to help curb the debilitating effects of decreasing bone density and the onset of osteoporosis. In males, bone loss normally starts between 45 and 50 years of age and proceeds at a rate of 0.4% to 0.75% per year (Watkins, 2009). This plays an important role in the declining physical ability of aging people because common mishaps such as falls can be devastating for the elderly, especially if they result in broken bones.

Aerobic endurance should be investigated when understanding the physical changes our bodies go through during the aging process. There are reasons for masters-level competitions when people compete in athletics; it is because physiological factors can play a huge role in a person's athletic prowess. When thinking about it logically it becomes apparent that cardiovascular efficiency is most likely something that also decreases with age and there is some staggering research that substantiates this. Individuals lose 20 to 30% of cardiac output by the age 65, oxygen uptake decreases approximately 9% (Kravitz, 2012). This information is

important to understand moving forward because it defines standards for sedentary people whose muscles may be atrophying. It is the goal of this synthesis to see if exercise can slow the decline of cardiovascular function.

The skin itself often shows the most outward signs of aging; older people tend to develop rougher, more spotted skin with less elasticity. This leads to wrinkles and sagging that are often features associated with age. These cosmetic issues may not directly shorten one's lifespan but they certainly are important when it comes to maintaining one's youthful appearance. According to Dugdale (2012), this occurs because "the number of pigment-containing cells decreases, but the remaining melanocytes increase in size. Aging skin thus appears thinner, more pale, and translucent. Large pigmented spots (called age spots or liver spots) may appear in sun-exposed areas." Is there anything we can do about this? Or are we simply destined to look old no matter what preventative measures we take? Perhaps there are cosmetics available on the market that can help slow this process; after all, it is a multi-billion dollar industry.

Aging affects the mental function of humans as much as the physical. The brain undergoes loss of cognitive function such as memory as it ages. According to Backman et al. (2000), cognitive functions decline as we age, this includes memory and speed of processing at a rate of 6% to 10% per decade. In other words, depletion of the brain occurs right alongside the depletion of the body, and is equally important. The body functions as a whole, so having physical function without mental function can be very limiting and vice versa.

Scope of the Synthesis

This synthesis investigates a critical mass to identify the critical signs of aging both physically and mentally. This is followed by a look into possible ways in which lifestyle and

nutritional aspects factor into slowing the natural aging process. Through the use of the critical mass, a plan is created for individuals to follow from their 20's through their 50's in an attempt to lengthen an individual's active life expectancy. The intent of the author is to develop a step by step program that, when followed, would potentially help anyone interested in maintaining youthful physical as well as mental characteristics.

Operational Definitions

Aging. Gradual change in an organism that leads to increased risk of weakness, disease, and death. This process takes place throughout the entire organism over its entire lifespan. It is generally categorized by a decline in biological functions due to metabolic stress. The declining organism experiences reduced immunity, loss of muscular strength, and endurance, a general decline in mental cognition, loss of skin elasticity and an accumulation of fibrous tissue in lieu of cardiovascular cells (Merriam-Webster, 2014).

Active life expectancy. The average number of years of life remaining in an independent state (i.e., free from significant disability) for a population of individuals (Merriam-Webster, 2014).

Muscle Mass. The weight of muscle in your body. Muscle mass percentage (lean body mass) is composed of your muscle, bone tissue, and the water in your body and organs. Calculating your muscle mass percentage is a great way to determine if one is in good shape (Merriam-Webster, 2014).

Aerobic Capacity. The maximum ability of an individual's body to transport and use oxygen throughout the body during exercise; often reflects upon the physical fitness level of the individual (Williams & Wilkins, 1995).

Body Composition. A health-related fitness component that relates to the relative amount of muscle, fat, bone and other vital parts of the body (Williams & Wilkins, 1995).

Bone Density. The amount of mineral matter per square centimeter of bones (Williams & Wilkins, 1995).

Skin Elasticity. A combination of skin-related attributes; including but not limited to complexion, stretchiness, thickness and durability of the skin as a whole (Williams & Wilkins, 1995).

Cognitive Function. In science, cognition is a group of mental processes that includes attention, memory, producing and understanding language, learning, reasoning, problem solving, and decision making (Williams & Wilkins, 1995).

Resistance Training. Physical training that utilizes isometric, isotonic, or isokinetic exercise to strengthen or develop the muscles (Williams & Wilkins, 1995).

Aerobic Training. Any of various sustained exercises, as jogging, rowing, swimming, or cycling, that stimulate and strengthen the heart and lungs, thereby improving the body's utilization of oxygen (Williams & Wilkins, 1995).

Diet. Particular selection of food, especially as designed or prescribed to improve a person's physical condition or to prevent or treat a disease (Merriam-Webster, 2014).

Nutrition. The process by which organisms take in and utilize food material (Merriam-Webster, 2014).

Dietary Supplement. Product that contains one or more ingredients (as vitamins or amino acids) that are intended to supplement one's diet and are not considered food (Merriam-Webster, 2014).

Summary

The anti-aging market is a multi-billion dollar business for a reason; people simply do not want to age poorly. The review of the critical mass will take a look at the dimensions of aging and the steps one can take to slow the aging process. The theories of aging have been identified, as well as the particular components of aging that occur. The synthesis will now examine the steps individuals can take to slow the aging process.

CHAPTER 2

METHODS

The data for this synthesis was obtained through literary searches from the Drake Memorial Library. The researcher used EBSCO host, SPORTDiscus, and MEDLINE all with full text. Google Scholar was used on several articles in lieu of going through interlibrary loan. To increase the quality of the search only academic journals, published thesis dissertations, and text books (excerpts) were used. All 24 articles that make up the critical mass met these criteria. The introduction section of the synthesis used a total of eight sources, seven of which were primary, and one of which was a secondary source. The author was then able to develop the critical mass for the literature review with 11 sources that all met the aforementioned standards. Articles only relevant to the synthesis were used. To be considered "relevant literature" for this synthesis the author set these standards; academic research, peer-reviewed, English, and full text. Furthermore, the content had to deal specifically with one of the four previously established anti-aging elements including physical activity, nutrition, supplementation, and cosmetics.

The key terms used for data collection of the introductory materials were "theories, aging, and body function," which came up with 712 hits. Next, an outline was developed to establish the four fundamental components of aging. These components were then searched to establish more specific and reliable sources. The next key terms searched were "anti-aging and body composition" which came up with 70 hits. The ensuing set of key terms searched were cardiovascular output and aging (10 hits), skin elasticity and aging (10 hits), and cognition and aging (13 hits). The author used this to information to establish the four areas anti-aging that the study would cover. The conclusions based off of the articles establish the most prevalent detrimental effects of aging. Since aging is such a complex area of study the author used the

theories to develop a base of knowledge and also to understand the most prevalent aspects of this process. The critical mass was developed by searching the data basis for similar terms related to the introduction. The author used the results found from the introduction material in an attempt to figure out ways to slow the aging process. The search yielded 13 hits for the combination of key words resistance training, muscle mass, and aging. Next, the author delved into the topic of aerobic training, aging, and prevention (9 hits). The author then searched the data bases for cosmetics anti-aging, and skin elasticity (1 hit). Finally, the author looked into nutrition and supplementation and longevity (7 hits). These searches were based off of the results found in the introduction section.

Through this data collection method it was possible to first analyze the theories and basic functions of the aging process as discussed in the introduction. The first step taken with these articles was to extract the methods; what are the basic signs of aging and why do they happen? This is an important step because the true signs of aging cannot be assumed, before a search takes place for prevention measures. This data can be retrieved from Appendix A.

Based on the findings of these articles a second search was done to see what the best preventative measures that could be taken to slow the signs of aging. This constitutes the results section. These articles were read and conclusions were examined to identify the preventative measures that could be used in the aging process. The conclusions are also used to determine the relationships between the aging process and the preventative measures.

Summary

Now that the data collection criteria and sources have been identified and considered, the following results section will be used to interpret what, if any, research-based effective age

prevention factors exists with respect to the aging areas mentioned earlier. The results section will determine what specific evidence-based factors exist to slow the aging systems and will provide recommendations for lifestyle choices to assist humans in avoiding acquired aging.

CHAPTER 3

RESULTS

Eleven studies were selected as the critical mass for the literature review to complete this synthesis. Based on the criteria stated in the methods section, results were found through a review of literature on the effects of physical activity, nutrition, supplementation, and cosmetics on anti-aging. This section will identify the results of these 10 studies to identify steps that can be taken to slow or halt the aging process. These results will be broken down into factors related to exercise (resistance training, aerobic training), nutrition, supplementation, and cosmetics' interventions.

Exercise and Anti-Aging

Strength training has long been associated with a decrease in sarcopenia. Sarcopenia, as previously noted, is a loss of muscle mass in individuals as they age. As mentioned, the accepted rate of muscle mass loss at age 25 is 0.5% per year, doubling at age 60 when inactive males begin to lose 1% per year and doubles again after the age of 70 when males begin to lose 2% per year (Chatterjee, 2012). Consequently, if left inactive the male body will undergo around a 30% decrease is muscle mass by age seventy" McCraken (2009). Hurley, Hanson, and Sheaff (2011), and Gomez-Cabello, Ara, Gonzalez-Aguero, Casajus, and Vicente-Rodriguez (2012) looked into the effects of resistance training and its effect on muscular development in aging adults. Hurley et al. (2011) concluded that elderly participants who did resistance training (RT) for 45 minutes, three times a week for 12 weeks saw an "average increase in muscle fiber of 32% and 30% strength increase opposed to the non-workout group." The increase in muscle mass demonstrates a positive association between RT and the elderly's ability to gain muscle mass. Gomez-Cabello et al. (2012) found weight training with high load intensities of 3 sessions per week and 2-3 sets

per session significantly reduces muscle mass loss in individuals. This 12-month study conducted on males age 30-55 yielded a 75% increase in overall strength of these individuals compared to the control group. These studies demonstrate how higher load RT can increase muscular strength and mass in an aging population, therefore, creating an anti-aging property. In conclusion, muscle mass can be maintained or even gained in individuals that are training at high intensities even into later adulthood.

In males, bone loss normally starts between 45 and 50 years of age and proceeds at a rate of 0.4% to 0.75% per year (Watkins, 2009). According to a Gomez-Cabello et al. (2012), and Whiteford et al. (2010), strength or resistance training proved to have positive effects on maintaining muscle mass and bone density in an aging population. They found whole body vibration exercises (WBV) are a promising alternative to prevent bone fractures. In a 12-month study conducted on males age 30-55, the WBV group that participated in five, 1 minute and 30 second sections 3 times per week "demonstrated 1% gains in hip and spine bone density" (Gomez-Cabello et al., 2012). According to a study by Whiteford et al. (2010), "one day of strength training per week increased bone density in the femoral neck region by 2.0%, and the lumbar region by 3.8%." Bone mass is a key contributor to the overall stability of a person as they age. Bone density loss can lead to increased fragility and lower mobility as we age which is a key contributor to less active lifestyles in the elderly. Based on these finding, adult males have some capacity to gain back bone density that is lost during the aging process and thereby strengthen their general body composition.

Booth and Zwetsloot (2010) investigated how strength training (ST) can stop some of the physical aspects of aging. More precisely, they attempted to see if workout intensity had an effect on the bodily functions related to aging. These functions were limited to free radical

damage and antioxidant enzyme production post-workout. Antioxidant production is considered a defense against the free radical theory of aging. The study found that "after 6 months participants in the high-intensity weight training group experienced oxidative damage from free radicals 11% higher than low-intensity weightlifting group" (Booth & Zwetsloot, 2010). Since free radicals are widely considered to be one of the main culprits of aging, the slowing of free radical damage will improve the function of muscles and delay mitochondrial oxidation, leading to less cellular depletion. In conclusion, individuals who work out at lower intensities more often can maintain similar benefits of working out but with less oxidative damage.

Research has been documented that "there is a 20 to 30% decrease in cardiac output by the age 65, and a maximal oxygen uptake decreases approximately 9% for males" (Kravitz, 2012). According to DeSouza et al. (2013), cardiovascular output can reach similar levels as younger males if the elderly are put through an exercise intervention. Their study was concluded by having test subjects perform two weeks of walking, 30 minutes per day, 3 to 4 days per week, at an intensity of 60% of their individually determined maximal heart rate. For the next 9 weeks the test subjects increased their workout load to 40 to 45 minutes per day and the intensity of their exercise to 70 to75% of their maximal heart rate for 5 to 6 days per week. After the exercise intervention, middle age males (age 50-76) had cardiovascular output similar to the level of the young adults (age 20-35) who had been trained in the same capacity (DeSouza et al., 2013). In other words, males who endurance train can maintain their aerobic capacity as they age.

Memory and speed of processing information deplete at a rate of 6-10% per decade after the age of forty (Backman et al., 2000). Mendelsohn (2013) investigated the effects of strength training on bodily functions besides sarcopenia and bone density. The study looked to establish

whether or not strength and balance training serves as a counter measure to decreased cognitive function in men ages 35-55. Mendelsohn (2013) found that the balance trained group (BAT) and the resistance trained group (RT) both performed better on the tests than the control group who did not engage in physical activity over the 3-month study. The results demonstrated that the "BAT / RT group significantly improved performance on the Stroop Test when compared to the control (P = .04). Furthermore, the BAT / RT group performed better on the associative memory task (P = .03)" (Mendelsohn, 2013). In other words, the groups that performed the workouts over the 3-month study period improved their scores on the tests they took more than those who were not engaging in physical activity. This shows the strong association between physical activities and improved cognitive function in middle age males. Furthermore, Schnohr, Marott, Lange, and Jensen (2013) found that elderly individuals who participated in low impact aerobic exercise (swimming, biking or walking) twice a week for just 20 minutes increased their cognitive function scores on an associative memory task test by 11% then when compared to the control.

Nutrition and Anti-Aging

Nutrition has been studied to understand its effect on the aging process. It has been concluded that a balanced diet, coupled with calorie restriction, may be one of the best ways to slow the aging process. Dabhade and Kotwal (2013), and Wilcox, Wilcox, and Todoriki (2007) investigated the effects on caloric restriction and the anti-aging process. Caloric restriction is the process of decreasing one's caloric intake over a period of time. Common theory is that one's metabolism is the driving force behind aging. Not only does it increase free radical oxidative damage in the body but also can lead to an increased thyroid hormone level (T3 hormone) which may cause the aging process. Furthermore, excess weight put on by eating too much may lead to

a variety of health problems as people age. Dabhade and Kotwal (2013) theorize that caloric restriction can slow the metabolism and therefore slow down the aging process. Their study found that middle age men that cut caloric intake by 15% or 300-500 calories over 18 months experienced lower levels of T3 production by 4% when compared to those that maintained caloric intake (Dabhade & Kotwal, 2013). In addition, Wilcox et al. (2007) found that caloric restriction lowers basal metabolic expenditure while fighting obesity, a factor which speeds up the aging process. Furthermore, they found that the oxidative process can be decreased 20% by caloric restriction of 15% (Wilcox et al., 2007). Not only is the oxidative process slowed but subjects in this study were significantly thinner and healthier, leading to less health risks and higher instances of longevity and healthier aging in general.

Supplementation and Anti-Aging

Keicolt-Glaser, Zeyer, and Lujan (2012) investigated whether essential fatty acids such as Omega 3's, fish oil, and DHA have a positive association with the aging brain. This study aimed to not only measure the effect of n-3 polyunsaturated fatty acid (PUFA) but also the effect on oxidative stress and telomere length in the brain (our brain maintenance chromosomes). In their 4-month study they created two study groups; one received a low dose n-3 (PUFA) (1.25 g/day) while the other received a high dose n-3 PUFA (2.5 g/day). When compared to a placebo, the high and low dose groups experienced significantly less oxidative stress on the brain measured by F-2 isoprostanes (P=.02) than the placebo group (Keicolt-Glaser et al., 2012). However, the increase in telomere length between the three groups was not statistically significant. In other words, n-3 supplementation in the diet can help fight free radical damage brought on by oxidation but does not do anything to help fight the decreased length of brain telomeres. N-3

polyunsaturated fats are found in many foods including, fish, nuts, and dark chocolate which are all high in flavonoids that help slow the aging process.

Growth hormone (GH) supplementation in adults has long been considered a way to reverse the aging process. A study by Rudman et al. (1990) looked to examine the effects of growth hormone on men over 60. They treated elderly men over 60 years old with .03 mg of growth hormone (IGF1 serum) per week for 6 months. This study found that the growth hormone "increased lean body mass by 9% and decreased the mass of adipose tissue by 14%, and it also increased skin thickness" (Rudman et al., 1990). Furthermore, the study found that bone density increased by "1.6% in the lumbar region of the non-placebo group" (Rudman et al., 1990). This demonstrated the positive effect of GH supplementation on elderly men in relation to body composition. Understanding how supplementation can affect multiple organs in our body is significant in answering the question of whether or not we can defy the aging process.

Cosmetics and Anti-Aging

Changes in the skin are the most visual signs of aging, and cosmetically some treatments have been found to counteract the natural aging process. Weiss, Ellis, Headington, Balter, and Diherty (1988) studied 30 Caucasian individuals and found that topical ointments such as retinoids have been found to decrease photo damage; one of the major signs of aging in skin. These cosmetics, such as topical tretinoin, are retinoids have been found to "decrease collagen 1 build-up and reverse UV photo damage on treatment sites" (Weiss et al., 1988). This study also found that "a 0.5% solution applied twice daily for 4 months increased hyper pigmentation, and wrinkles in the elderly and reestablished a rosy glow" (Weis et al., 1988). Overall, the study

found a positive association between a number of retinoid compounds and treatment of photo-aged skin.

Summary

The anti-aging process is a well-documented topic, and the results of these 10 studies have all been associated with the slowing of the aging process. There are documented theories that explain the aging process, and plenty of studies that have attempted to solve the aging dilemma. However, these studies are often done in a short time frame, which is a paradox in that aging is a long process. Quality science has not been around long enough to test these over a significantly long enough time period. However, the information accumulated to date and used in this synthesis points to some very promising anti-aging trends.

CHAPTER 4

DISCUSSION

The goal of this synthesis was to determine if there are steps that can be taken to halt or slow the aging process. The introduction chapter demonstrates that there are general time-dependent elements of the aging process that will occur no matter what we do; these are things such as the gradual wear and tear on our organs and the eventual death of the individual. However, there are some processes of acquired aging such as a decline in cognitive function, loss of muscle mass and bone density, loss of skin elasticity, and decline in aerobic capacity that can be halted with proper exercise, nutrition, supplementation, and cosmetic treatments. Both types of aging can happen for a number of reasons or may be based on the theories introduced in the introduction, such as the Free Radical Theory. The following discussion includes topics related to interventions that are supported by the critical mass in all domains to slow the acquired aging process. These include interventions that our critical mass supports in the field of body composition (loss of muscle mass, bone density), loss of cognitive function, lower aerobic capacity, and skin elasticity.

Exercise and Anti-Aging

After the review of literature was completed for this synthesis a conclusion was drawn that males can take some steps to halt the acquired aging process. Exercise, both resistance training and aerobic exercise seems to be a well-documented method to stopping the acquired aging process as demonstrated by Booth and Zwetsloot (2010). Exercise seems to have a positive effect on the maintenance of body composition (muscle mass, bone density), cognitive function, and aerobic capacity as depicted in the effect of exercise on aging areas in Figure 1. The author believes that resistance training is the single best way to extend the active life span. The critical

mass of literature demonstrates that resistance training is supported as evidence-based practice as the best way to fend off negative impacts of aging in three areas this synthesis examines (body composition, cognitive function, and aerobic capacity). Figure 2 outlines a sample fitness plan by age decade that would, in fact, extend the active lifespan of an individual.

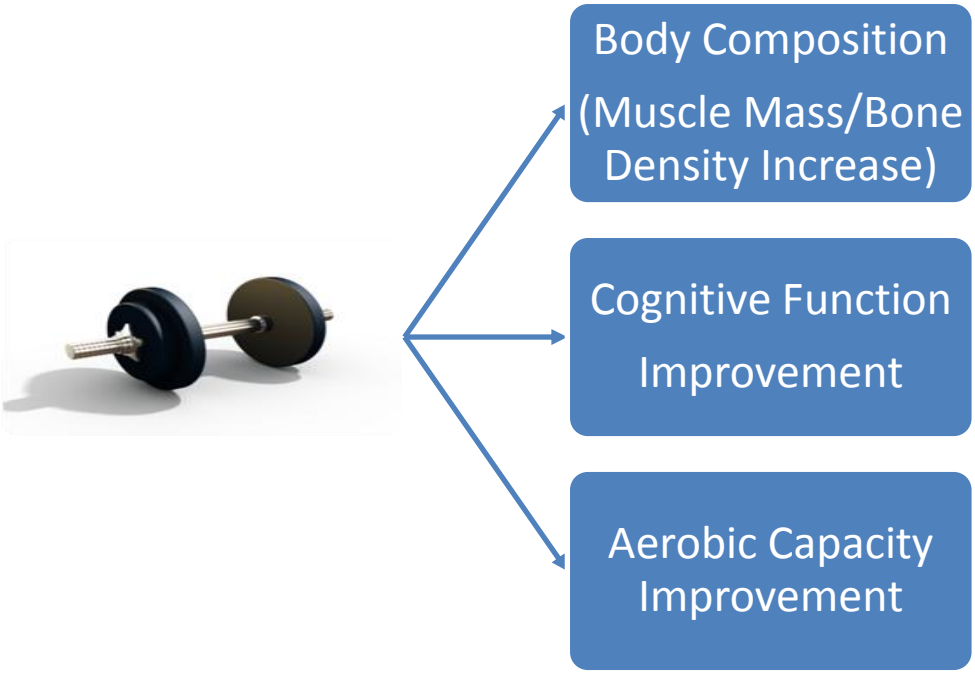

Figure 1. Effects of exercise on aging areas. This figure depicts the effects of exercise on body composition, cognitive function, and aerobic capacity.

Depletion of muscle mass, also known as sarcopenia can be slowed considerably with resistance training as found by Hurley et al. (2011) and Gomez-Cabello et al. (2012). Individuals that maintain muscle mass and strength longer into life have the ability to perform daily activities for more years those who do not. Furthermore, maintaining muscle mass allows for individuals to avoid injury and keep that youthful appearance. As individuals age, they often put on more weight in the form of adipose tissue; building muscle can combat this problem by raising one's

metabolism. Excess weight gain, and a loss of strength keeps individuals from performing activities they may have done during their youth.

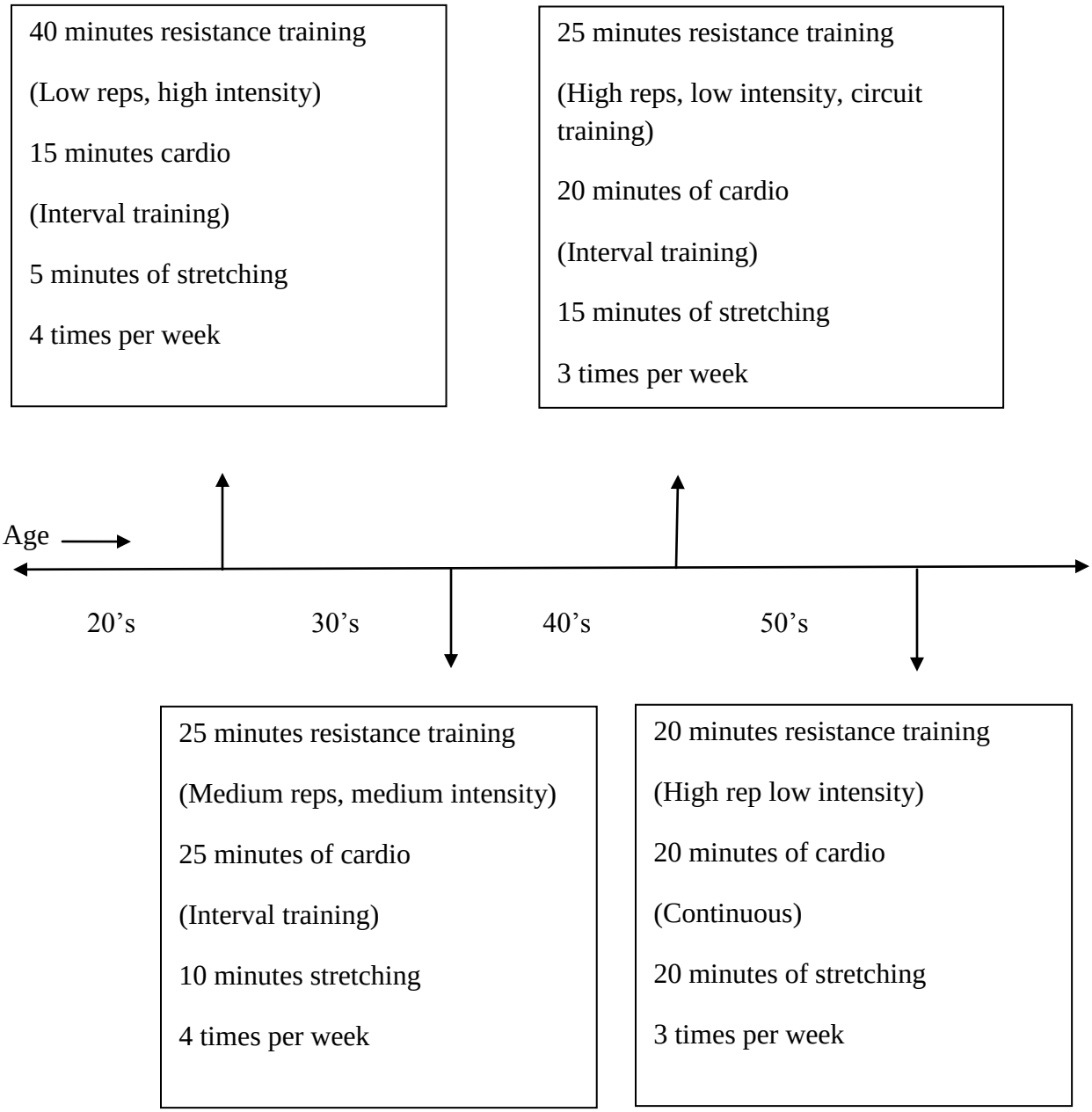

Figure 2. Fitness plan. This figure details a fitness plan by age decade from the 20's to the 50's.

The critical mass also demonstrates that people can maintain bone density as they age with a quality weight training regimen. The Gomez-Cabello et al. (2012) and Whiteford et al.

(2010) studies highlight the importance of resistance training by showing that with proper exercise bone density is maintained in males even with advanced age. These authors and others have noted a cycle of effects where increased bone density can facilitate later physical activity. Such is the case if a person ages and avoids injury and is now able to train more. The opposite is also true base on the critical mass of literature where weak bones decrease the ability to do daily activities and broken bones, particularly major breaks such as hip fractures, can cause disability and ongoing pain. An increase in bone density means that individuals will have less of a chance of getting injured as they get older. This means people can live more active lifestyles as they get older because physical activity decreases the chance of injury. Physical activity coupled with high calcium intake strengthens bones, which is why simple weight-bearing exercises coupled with high calcium diets are recommended for men of any virtually any age (Preventing and Reversing Osteoporosis, 2012) The critical mass provides information that agrees with this, and demonstrates that resistance training can stop osteoporosis and other related diseases from occurring. Figure 3 illustrates the circular effect of resistance training on maintaining bone density, and its relationship to having stronger bones and a having longer active lifespan.

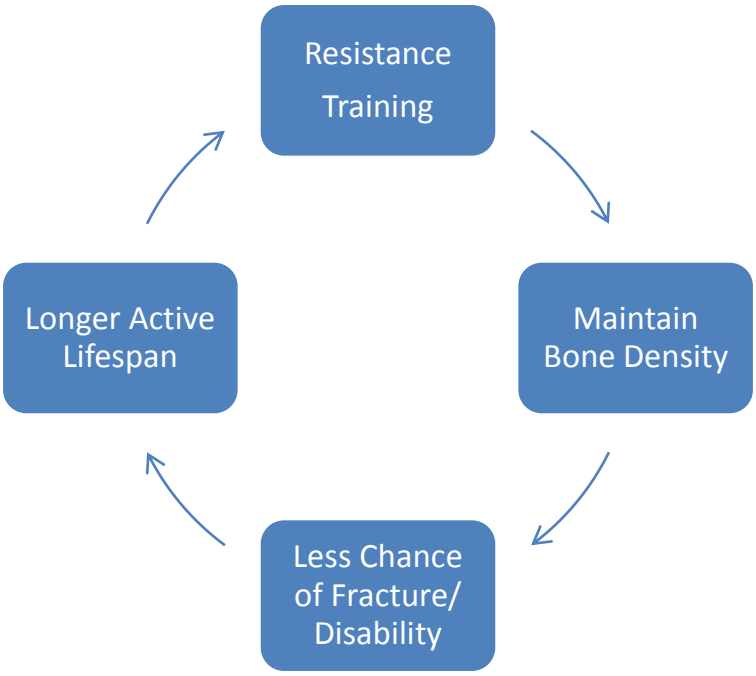

Figure 3. Effects of resistance training. This figure illustrates the circular effects of resistance training on maintaining bone density, having stronger bones, and having a longer lifespan.

Resistance and aerobic training impact cognitive function in adults, which contributes to a better quality life as we age. An improved cognitive function means that individuals will have improved memory and executive control, not to mention less anxiety and they may even experience less chronic fatigue and improved self-esteem (Anderson-Hurley, Nimon, & Westen, 2011). For males, this demonstrates that with higher cognitive functioning skills it is likely that longer and more independent life is possible over those who remain sedentary throughout the lifespan. Often, memory-associated diseases such as dementia and Alzheimer's take people's independence from them before their physical functions leave them; weight training has been proven to combat these debilitating diseases. According to Mendelsohn (2013), both balance and strength workouts improve cognitive function for a battery of tests including the Stroop Test; they also performed better on the associative memory task. The critical mass demonstrates that

aerobic exercise has similar benefits to strength and balance training according to Schnohr et al. (2013). Therefore, it is concluded through the literature that individuals should maintain an exercise regimen to keep cognitive function from diminishing with age.

The critical mass demonstrates that aerobic training may also have a positive impact on slowing the loss of cardiovascular output in older adults. Cardiovascular efficiency is the single most important dynamic of aging and is critical to maintain throughout life. The author believes this is the case because cardiovascular efficiency lowers the risk of obesity, heart disease, and high blood pressure (Schnohr et al., 2013). Furthermore, maintaining an aerobic exercise plan helps individuals maintain body composition by keeping extra weight off. According to DeSouza et al. (2013), cardiovascular output can reach similar levels as younger males if the elderly are put through an exercise intervention. Figure 2 illustrates a fitness plan that can be implemented throughout one's lifespan to help keep body composition, aerobic capacity, and cognitive function at bay.

Nutrition and Anti-Aging

Nutrition is a key element to putting off the acquired aging process by affecting body composition and limiting free radical damage as depicted in Figure 4. By maintaining a quality nutrition plan individuals should be able to maintain an ideal body composition (BMI between 10-25%) (Hartel , 2013). Diets that are lower in total calories also help an individual maintain ideal body weight which overall makes them healthier and more prone to longevity (Wilcox et al., 2007). This study has concluded that individuals should develop an eating plan that is based upon age, and an activity level to ensure the best results. Table 1 has been developed to break down the individual nutritional and supplementation needs of people at all stages of life. It has

been documented that several key nutritional elements should increase over time as an individual strives to maintain proper bodily functions, while overall caloric intake should decrease with age. In other words, individuals should eat less food as they grow older but get more nutritional value out of it. Furthermore, poor nutrition leads to excess body weight which contributes not only to more falls but also increased severity of these falls. An injury that keeps individuals from performing physical activity for an extended period of time leads to a faster rate of aging due to the fact they cannot work out anymore and thus suffer the same outcome as someone who is able but chooses not to exercise.

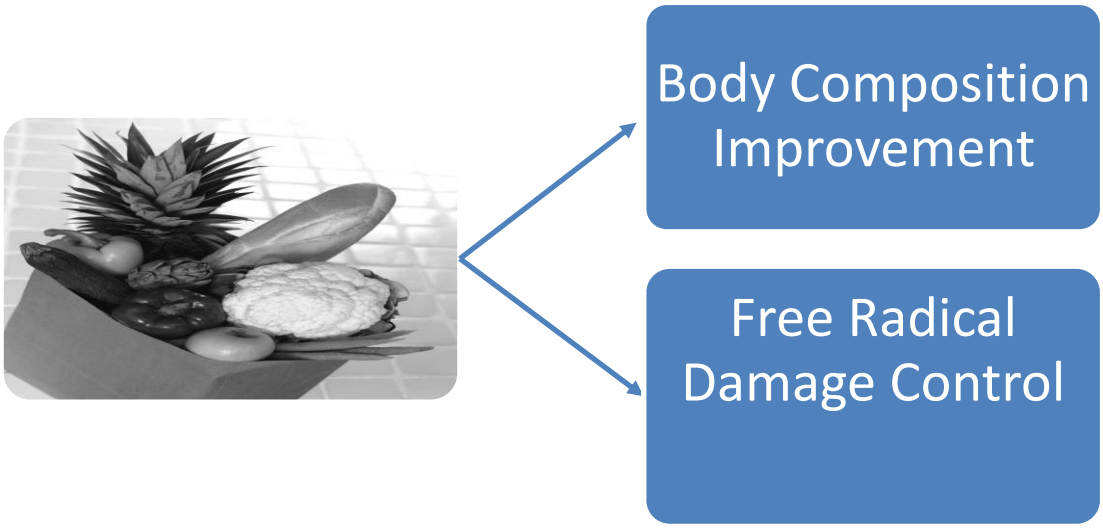

Figure 4. Effects of nutrition. This figure depicts the effects of nutrition on body composition and free radical damage.

Proper nutrition also serves to deter free radical damage which is a driving force behind all of the major aging processes. More studies would have to be done to see how nutrition affects the individual components of the aging process over a long period of time. However, in the studies performed by Dabhade and Kotwal (2013), and Wilcox et al. (2007), they demonstrate the idea that caloric restriction can be put into place in order help slow some major functions of

the aging process. By cutting daily caloric consumption by 300 to 500 calories one may be able to significantly slow free radical damage which is a major cause of aging (Dabhade & Kotwal, 2013). Many people can benefit from caloric restriction in an attempt to slow down metabolism and keep the body from showing premature signs of aging.

Table 1

Nutrition and Supplementation Guidelines: (Male 155 Pounds)

	20 - 35 Years Old	**35 - 50 Years Old**	**50 and Older**
Supplemental Needs	Vit A - 1,250 IU 2x/day Vit B1 - 125 mg 2x/day Vit B2 - 125 mg 2x/day Vit B6 - 2 mg daily Vit B12 - 250 mg Vit D3 - 500 IU 2x/day Vit E - 200 IU 2x/day Vit F - 200 mg 2x/day Niacin - 15 mg 2x/day Biotin - 150 mg 2x/day Calcium-500 mg 2x/day Magnes- 200 mg 2x/day Zinc - 7.5 mg 2x/day Potassium - 4 fruit/day Lycopene - 400 mg/wk Omega 3 - 600 mg DHA/day	Vit A-1,250 IU+ 2x/day Vit B1 - 125 mg 2x/day Vit B2 - 125 mg 2x/day Vit B6 - 2 mg 2x/day Vit B12- 400 mg 2x/day Vit D3 - 500 IU 2x/day Vit E - 200 IU 2x/day Vit F - 200 mg 2x/day Niacin - 15 mg 2x/day Biotin - 150 mg 2x/day Calcium-600 mg 2x/day Magnes- 200 mg 2x/day Zinc - 7.5 mg 2x/day Potassium - 4 fruit/day Lycopene - 400 mg/wk Omega 3 - 600 mg DHA/day	Vit A > 1,250 IU 2x/day Vit B1 - 125 mg 2x/day Vit B2 - 125 mg 2x/day Vit B6 - 2 mg 2x/day Vit B12- 400 mg 2x/day Vit D3 - 400 IU 2x/day Vit E - 200 IU 2x/day Vit F - 200 mg 2x/day Niacin - 15 mg 2x/day Biotin - 150 mg 2x/day Calcium-600 mg 2x/day Magnes- 200 mg 2x/day Zinc - 7.5 mg 2x/day Potassium - 4 fruit/day Lycopene - 400 mg/wk Omega 3-600 mg DHA/day Pantothenic Acid - 150 mg 2x/day Acetyl-L-750 mg 2x/day
Caloric Intake	<u>Sedentary</u> 2,400 - 2,600 cals/day <u>Moderately Active</u> 2,600 - 2,800 cals/day <u>Active</u> 2,800 - 3,000 cals/day	<u>Sedentary</u> 2,400 cals/day <u>Moderately Active</u> 2,600 cals/day <u>Active</u> 2,800 cals/day	<u>Sedentary</u> 2,200 cals/day <u>Moderately Active</u> 2,400 cals/day <u>Active</u> 2,600 cals/day
Macronutrient Needs	<u>Sedentary</u> Carbs - 270g/day Protein - 180 g/day Fat - 66 g/day Fiber - 22 g/day <u>Moderately Active</u> Carbs - 302g/day Protein - 202 g/day Fat - 75 g/day Fiber 23 g/day <u>Active</u> Carbs - 337 g/day Protein - 225 g/day Fat - 83 g/day Fiber - 25 g/day	<u>Sedentary</u> Carbs - 270g/day Protein - 180 g/day Fat - 66 g/day Fiber - 22 g/day <u>Moderately Active</u> Carbs - 302g/day Protein - 202 g/day Fat - 75 g/day Fiber - 23 g/day <u>Active</u> Carbs -315 g/day Protein - 210 g/day Fat - 77 g/day Fiber - 23 g/day	<u>Sedentary</u> Carbs - 247 g/day Protein- 165 g/day Fat – 61 g/day Fiber > 25 g/day <u>Moderately Active</u> Carbs - 270g/day Protein - 180 g/day Fat - 66 g/day Fiber > 25 g/day <u>Active</u> Carbs - 302g/day Protein - 202 g/day Fat - 75 g/day Fiber > 25 g/day

Table 1

Note. Table 1 is adapted from *The Harvard Medical School Guide to Men's Health*, p. 107, (Simon, 2002).

Supplementation and Anti-Aging

There has been much research done in the field of supplementation to stop the aging process. Rudman et al. (1990) found that humans that supplement with growth hormone (GH) may be able to slow the aging process in four separate dimensions as depicted in Figure 5. The first of these dimensions is muscle mass; older men age 60 and above with GH experienced a 9% increase in lean muscle mass (Rudman et al., 1990). These individuals (males over the age of 60) were able to gain back significant muscle mass. More research in this field could be done to see GH's effects over a long period of time. Rudman et al. (1990) found that men using GH could also experience significant increase in bone density and skin thickness. Loss of bone density and skin thickness are two preventable side effects of the aging process that can be mitigated with proper supplementation. The issue found with the use of growth hormone is that it has debilitating effects on the rest of the body over long periods of time. In short periods of time GH works wonders on the body while it combats the aging process, however, over time it becomes very dangerous to use (Oz, 2006). This is why more studies are not performed with supplements such as GH or steroids. Overall, this study suggests proper supplementation with more natural products such as those shown in Table 1.

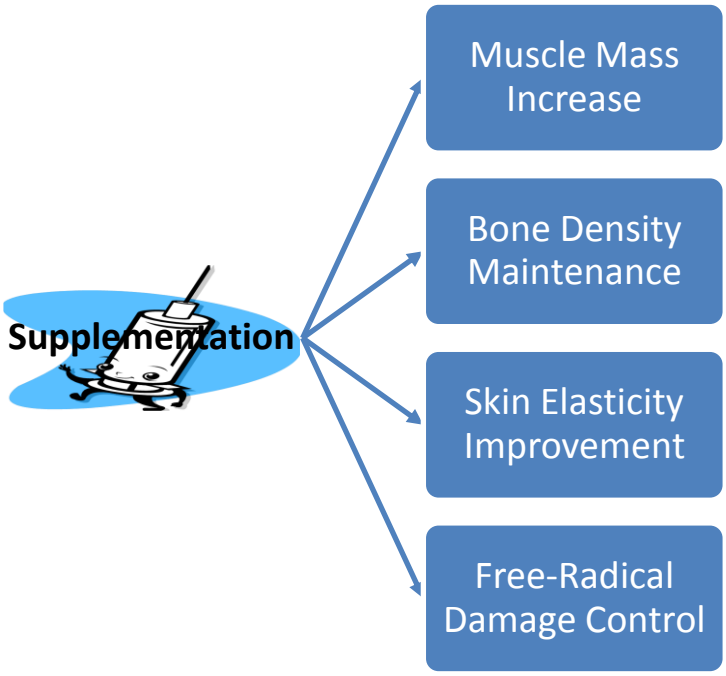

Figure 5. Effects of supplementation on aging. This figure depicts the interaction of supplementation on muscle mass, bone density, skin elasticity, and free radical formation.

Supplementation in the form of over the counter vitamins and minerals is a multi-billion dollar industry, and there is a huge marketplace for anti-aging vitamins. Thus far some supplements have demonstrated a positive association with anti-aging and therefore could be used in a regimen that can fight off the effects of aging. Since supplementation with growth hormone is illegal and expensive the author feels that the next best option is supplementing with Omega 3 fatty acids. These supplements not only fight free radical damage but supplementation with products such as fish oil, DHA, and Omega 3 fatty acids have all demonstrated positive effects on stopping free radical damage of the brain, and other parts of the body. These supplements may, in fact, protect against oxidative damage which leads to an increase in cognitive function (Keicolt-Glaser et al., 2012). Furthermore, large amounts of Omega 3 fatty acids have been found to prevent sarcopenia in older adults when combined with an anabolic

stimulus such as weight training (Di Girolamo et al., 2014). Therefore, it is suggested that we implement the use of these products starting from the early 20's continuing on into later adulthood.

Cosmetic Care and Anti-Aging

Skin changes are among the most visible signs of aging in both males and females. Evidence of increasing age include wrinkles and sagging skin; whitening or graying of the hair is another obvious sign of aging (Dugdale, 2012). For males, cosmetic care provides great benefits for those looking to put off the look of elderly skin because cosmetics improve skin elasticity as depicted in Figure 6. Much can be done in creating a regimen that allows for the skin to remain supple and youthful in appearance. Aging people must be diligent in their skin care to insure that their skin remains glowing throughout their lifetime. People of all different ages must focus on different aspects of skin care in order to maintain optimal results.

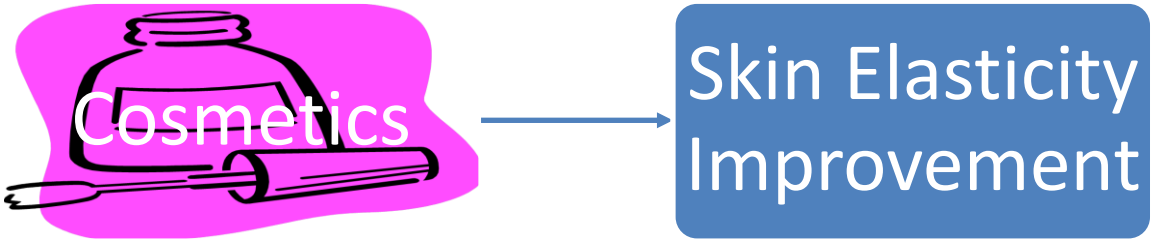

Figure 6. Effects of cosmetics. This figure depicts the interaction of cosmetics on skin elasticity.

The critical mass examines how some retinoids help cancel out harmful damage done by the sun, and if applied with diligence may help slow the acquired aging process. Research suggests cleansing the face in the morning and at night along with using sun protection in the form of SPF with moisturizer as great ways to increase the health of one's skin (Fahey, 2012). Biologically, skin is attacked by free radicals, so applying solutions that include free radical protective agents can help keep skin looking young. These products are often called serums and are applied more frequently as one ages. Skin care should occur in certain areas more than others. For example, the face and neck are at high risk due to sun damage. If one follows the guidelines in Table 2 they may be able to keep aging skin at bay.

Table 2

Cosmetic (Skin Care) Guidelines by Age Group

20 - 30 Years Old	**30 - 40 Years Old**	**40 - 50 Years Old**	**50 and Older**
Use a gentle foaming cleanser in morning and at night	Light exfoliating skin cleanser at night and in the morning	Cleanse using a basic non-foaming, non-drying cleanser in combination with a gentle face cleansing brush both day and night	Use a cream cleanser that will hydrate skin while it cleanses (morning and night)
Use a light moisturizer that contains sunscreen with UVA and UVB protection during the day	Use hydrating eye cream both day and night	Use SPF daily	Choose a moisturizing cream that contains SPF to keep skin hydrated
Spot treat acne with solutions containing salicylic acid or benzoyl peroxide	During the day apply sunscreen, along with an antioxidant-rich moisturizer, serum or lotion	Use a retinoid and peptide serum daily	Apply a peptide-rich serum under your SPF daily to help build collagen. Look for one that also contains antioxidants to fight free radicals or hyaluronic acid to lock in moisture
Use hydrating eye creams	Add a retinoid to your regimen to help improve the overall texture and tone of your skin	Use anti-aging product specifically formulated for the neck that include phytoestrogens	At night, apply a retinoid before your moisturizer. Your moisturizer should contain phytoestrogens
		Use a moisturizer that has a high level of glycerin or hyaluronic acid daily	Use petroleum jelly during the day

Table 2

Note. Table 2 is adapted from *The Harvard Medical School Guide to Men's Health*, p. 213,

(Simon, 2002).

Summary

In conclusion, the author believes that maintaining an active lifestyle full of strength and cardiovascular exercise is the most important way to improve the active lifespan in males. This belief is supported by the critical mass of literature. Not only does performing a well-balanced exercise regimen help males maintain a healthy body composition but it also contributes to injury prevention. The author believes that this is a circular concept; those who work out will stay healthy allowing them to in turn work out more and become healthier. In order to increase total lifespan or reduce the chance of early mortality the author believes individuals must maintain proper nutrition, and supplementation. Having a well-balanced diet consisting of proper nutrients and constant supplementation with Omega 3 fatty acids, an individual can protect against free radical damage and help themselves maintain a quality body composition. Free radical protection helps defend against aging at the molecular level and slows the overall aging process at the macro level. Body composition plays an integral role in allowing for individuals to avoid injury and age-related diseases as they grow older. The author believes cosmetic care fights the most visual signs of aging. Maintaining a regimen of cosmetic care allows for an individual's superficial appearance to remain youthful.

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Appendix

Author	Title	Style of Intervention	Body Composition	Aerobic Capacity	Cognitive Function	Free Radical Damage Prevention	Skin Elasticity	Findings
Hurley et al. (2011)	Strength training as a countermeasure to aging muscle and chronic disease	Resistance Training	Yes					Resistance training (RT) for 45 minutes three times a week for 12 weeks saw an "average increase in muscle fiber of 32% and 30% strength increase opposed to the non-workout group
Gomez-Cabello et al. (2012)	Effects of training on bone mass in older adults	Resistance Training	Yes					3 session per week, 2-3 sets per session significantly reduces muscle mass loss in individuals. This 12-month study conducted on males age 30-55 yielded a 75% increase in overall strength of these individuals compared to the control

								group. In a 12 month study conducted on males age 30-55 the WBV group that participated in five 1 minute and 30 second section 3 times per week "demonstrated 1% gains in hip and spine bone density
Whiteford et al. (2010)	Effect of a 1 year randomized control trial of resistance training on lower limb bone and muscle structure and function in older men	Resistance Training	Yes					The intervention showed a significant increase in total hip BMD for both groups at 12 months (active control, 1,014-1,050 mg/cm(2); resistance, 1,045-1,054 mg/cm(2), $p < 0.05$)
Booth and Zwetsloot (2010)	Basic concepts about genes, inactivity and aging	Resistance Training					Yes	After 6 months participants in the high intensity weight training group experienced oxidative damage from free radicals 11% higher than low-intensity weightlifting group
DeSouza et al. (2013)	Regular aerobic exercise prevents and restores age-related declines in endothelium-dependent vasodilation in healthy men	Aerobic Training 9 weeks the Test subjects increased their workout load to 40 to 45 minutes per day and the intensity of their exercise to 70% to 75% of their maximal heart rate for 5 to 6 days per week		Yes				After the exercise intervention, "acetylcholine-mediated vasodilatation increased ≈30% (P<0.01) to levels similar to those in young adults and middle aged and older endurance-trained men"
Mendelsohn (2013)	Trade-offs between anti-aging dietary supplementation and exercise.	Resistance training/ Balance training			Yes			The results are demonstrated the "BAT/ RT group significantly improved performance on the Stroop Test when compared to the control (P = .04). Furthermore, the BAT/RT group performed better on the

								associative memory task (P = .03)"
Dabhade and Kotwal (2013)	Tackling the aging process with bio-molecules: a possible role for caloric restriction, food-derived nutrients, vitamins, amino acids, peptides, and minerals.	Nutrition					Yes	Middle age men that cut caloric intake by 15% or 300-500 calories over 18 months experienced less saw a "lower levels of T3 production by 4% when compared to those that maintained caloric intake"
Wilcox et al. (2007)	Caloric restriction, the traditional Okinawan diet, and healthy aging: the diet of the world's longest-lived people and its potential impact on morbidity and life span.	Nutrition					Yes	"oxidative process can be decreased 20% by caloric restriction of 15%."
Keicolt-Glaser et al. (2012)	Omega 3 supplementation lowers inflammation in healthy middle-aged and older adults: A randomized controlled trial.	Supplementation					Yes	When compared to a placebo the high and low dose groups experienced significantly less oxidative stress on the brain measured by F-2 isoprostanes (P=.02) than the placebo group.
Rudman et al. (1990)	Effects of human growth hormone on men over 60 years old	Supplementation	Yes			Yes		Growth hormone "increased lean body mass by 9% and decreased the mass of adipose tissue by 14%, and it also increased skin thickness" Furthermore, the study found that bone density increased by "1.6% in the lumbar region of the non-placebo group."
Weiss et al. (1988)	Topical retinoid improves photoaged skin	Cosmetics				Yes	Yes	Cosmetics such as topical tretinoin are retinoids that have been found to "decrease collagen 1 build-up reverse UV photo damage on treatment sites" A 0.5 % solution applied twice daily for 4 months increased hyper pigmentation, and wrinkles in the elderly and reestablished a rosy

								glow”