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Changes in IGF-1 Levels Post Deer Antler Velvet Supplementation

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CHANGES IN IGF-1 LEVELS POST DEER ANTLER VELVET SUPPLEMENTATION

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ABSTRACT

Changes in IGF-1 Levels Post Deer Antler Velvet Supplementation

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Context: Deer antler velvet has been used in traditional Chinese medicine for thousands of years but has recently gained popularity in Western medicine as an ergogenic aid. According to Oriental medicine deer antler velvet can be attributed to enhancing immune system function, improving athletic performance, increasing muscle recovery, enhancing sexual function, improving disease recovery, and enhancing cardiovascular function. Deer antler velvet is orally taken in pill, powder or spray form. Although a number of health and human performance effects have been attributed to deer antler velvet the scientific rationale behind these beliefs is ambiguous **Objective:** The purpose of this study was to determine if sublingual capsular deer antler velvet supplementation increases IGF-1 levels in humans. **Design:** Double-blind study **Setting:** Exercise Physiology Laboratory **Patients or Other Participants:** Twenty-eight UNLV students (13 females, 15 males) between the ages of 18-45 volunteered to participate in this study. Inclusion criteria: men and women between the ages of 18-45, who were considered normal weight healthy adults (BMI= 20-24.9kg/m^2) or obese adults (BMI>30kg/m^2). Exclusion criteria included: collegiate level athletes, individuals who participate in activities where they might be drug tested as well as individuals who are drug tested for work. These individuals were excluded due to the lack of regulation by the FDA in supplementation concentration and processing. Women who were or thought they might be pregnant were excluded due to potential risk of hormonal imbalance. Twenty-two (10 females, 12 males) of the twenty-eight participants were utilized for data analysis (25.36±4.99 years old, body mass-81.89±19.4 kg, height-173.57±10.89cm). **Interventions:** The independent variables for this study were deer antler

velvet and placebo groups. Participants were randomly assigned to the deer antler velvet intervention or placebo intervention. Blood was drawn pre and post-supplementation using the finger stick method, it was then centrifuged and placed in a freezer located in the Exercise Physiology Lab for storage at -70 degrees Celsius. **Main Outcome Measures:** The main outcome measure for this study was IGF-1 levels. IGF-1 levels were analyzed using Human IGF-1 ELISA kits, manufactured by LifeSpan BioSciences, Inc. The mean optical densities provided on the ELISA plates were used to calculate post-supplementation IGF-1 concentrations. Data were analyzed using SPSS version 24. An independent t-test was used to determine the difference in IGF-1 measurements post-supplementation between the two interventions. Pearson's correlation tests were run to analyze the relationship between post-supplementation IGF-1 levels and fat free mass, and IGF-1 levels and dairy consumption. **Results:** Independent t-test revealed no statistically significant difference (p=.094) post-supplementation between the deer antler velvet and placebo groups. There was no significant correlation (p=.113) between fat-free mass index and IGF-1 levels. There was also no significant correlation (p=.254) between average dairy consumption and IGF-1 levels. **Conclusion:** This study did not identify an increase in IGF-1 levels between the deer antler velvet and placebo groups post 7-day supplementation and did not find a meaningful correlation between dairy consumption or fat-free mass and IGF-1 levels.

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CHAPTER 1- INTRODUCTION

Sports performance has become increasingly competitive at the elite and recreational levels. Athletes are seeking any advantage they can get over their competitors, often turning to substances banned by the World Anti-Doping Agency (WADA). Alternatively, athletes are choosing nontraditional dietary supplements and unconventional training programs to enhance performance. It is not a new practice for athletes to implement a restricted and regimented diet, to optimize health and performance. However, the use of food and other dietary supplements as an ergogenic aid have become modern practice. An ergogenic aid is defined as a performance enhancer that gives a mental or physical edge during competition. Ergogenic aids can range from caffeine to illegal substances. Other dietary aids used at the elite level are beetroot juice and antler velvet.

Deer antler velvet has been used in Oriental medicine for thousands of years (Syrotuik et al. 2005), however in the last decade its popularity as an ergogenic aid in the sports community has risen. According to Oriental medicine deer antler velvet can be attributed to enhancing immune system function, improving athletic performance, increasing muscle recovery, enhancing sexual function, improving disease recovery, and enhancing cardiovascular function (Broeder et al. 2004). Deer antler velvet is taken orally in pill, powder or extract form. Although many health and human performance effects have been attributed to deer antler velvet the scientific rationale behind these beliefs is ambiguous (Sleivert et al. 2003). The rationale likely related to these beliefs is that the antler is the only mammalian organ with the ability to

regenerate itself and if ingested these properties will benefit the user (Gilbey & Perezgonzalez, 2012).

Antlers on the deer/elk are an organ rather than a horn, which means the antlers grow cyclically and once calcified eventually shed after mating season. The antler velvet is the outermost layer of skin covering the antler. To avoid calcification, the antler is collected midway through the growth cycle. The deer or elk are raised similar to cattle; the antler is humanely harvest after an anesthetic has been given to the animal. The antler collection process consists of applying a tourniquet at the base of the antler, once this has been done the antler is removed with a clean, sharp cutting instrument. There are two conventional methods for velvet extraction, those being dry ice or stripping of the velvet. After the velvet has been extracted from the antler it is sterilized via heat or alcohol and the powder is ground and made into capsules or pills.

Deer antler velvet has been attributed as a source of insulin-like growth factor (IGF-1), which in its synthetic form is a banned substance included on the WADA prohibited list. However, IGF-1 in deer antler velvet is a natural animal product similar to that found when consuming red meat or dairy products, therefore in its natural form is not a banned substance. IGF-1 levels have been positively correlated ($p<.001$)with consumption of dairy protein or calcium (Crowe et al., 2009). IGF-1 is a hormone produced by the liver found in the blood and is similar in molecular structure to insulin. IGF-1 is stimulated by growth hormone, its main function in the body being stimulating cell growth and regeneration. Therefore, IGF-1 has been inversely

correlated with blood glucose levels in obese participants (p=.02) (Rasmussen et al. 1994). The function of cell growth and regeneration is what has led IGF-1 to be used as a performance enhancer. IGF-1 shares a similar molecular structure to insulin which cannot be consumed orally due to it being broken down in the digestive system, IGF-1 can be absorbed into the circulatory system via sublingual administration. A recent study was conducted on mice the results suggest that when orally administered IGF-1 mainly acts at the intestine although, a portion of the IGF-1 was absorbed into general circulation (Kim et al. 2004). There has been no research as to whether IGF-1 consumption through deer antler velvet capsules, can be absorbed into the human circulatory system.

PURPOSE

The purpose of this study was to determine if sublingual capsular deer antler velvet supplementation increases IGF-1 levels in humans.

OVERARCHING RESEARCH HYPOTHESES

Hypothesis 1: It was hypothesized that deer antler velvet supplementation would increase levels of IGF-1 post intervention. 2: It was hypothesized that participants with a higher fat-free mass index, estimate by SECA medical body composition analyzer would have a positive correlation to levels of IGF-1. 3: It was hypothesized that participants with higher dairy consumption would have a positive correlation to levels of IGF-1.

CHAPTER 2- REVIEW OF LITERATURE

The following literature review has focused on the effect of antler velvet on seven subcategories of general health and wellness. These subcategories are broken down as follows: (a) chemical composition of antler velvet, (b) immune system function, (c) cardiovascular function, (d) disease recovery, (e) sexual function, (f) cell recovery/tissue remodeling and (g) athletic performance.

Chemical Composition of Antler Velvet

Antlers are a unique organ that display an annual cycle of growth in male deer and elk, as well as in female reindeer (Zhou & Li, 2009)(Sui et al. 2014). This growth process occurs rapidly at the tip, the maximum growth rate recorded in elk was 2.75cm per day (Sui et al. 2014). During this three-month period cartilage, bone, nerve cells, and blood vessels grow at the same rate (Sui et al. 2014). Due to this rapid growth antler velvet is contributed to having high concentrations of growth factors (Cox & Eichner, 2013) (Sui et al. 2014)(Gu et al., 2007). Several studies suggest that the composition of antler velvet is dependent on the antler region and stage of development also varying with species the antler originated from (B. T. Jeon et al., 2011). Developing antlers are composed of fibroblasts, osteocytes, chondrocytes and chondroblasts (Gu et al., 2007). The antler can be divided into four different sections that include: the base, middle-section, upper-section and tip (Gu et al., 2007).

The velvet from antlers is rich in amino acids, antioxidants, proteins and polypeptides (Sui et al. 2014) (Zhou & Li, 2009)(B. Jeon et al., 2009) (B. T. Jeon et al., 2011). Several studies have reported that crude protein decreased from tip to base, while ash content increased from tip to base (B. Jeon et al., 2009) (B. T. Jeon et al., 2011). Jeon et al. also found that when

comparing antler harvest at 65, 80, and 95 days' collagen content of the middle (25%) and base section (30%) was higher at the 65-day group than the 95-day group ($p<.05$). This data supports the idea that with a longer stage of antler development before extraction, mineralization lowers the contents of bioactive components (Gu et al., 2007) (B. T. Jeon et al., 2011).

Antler velvet is one of the very few natural sources of IGF-1 protein (Gu et al., 2007) (Cox & Eichner, 2013). In a study conducted by Gu et al. results demonstrated the expression of the IGF-1 gene throughout all four sections of the antler. Similar to the other bioactive components there was a lower expression of IGF-1 in the base section in comparison to the tip. These results further validating the idea of deceleration of growth in the base section due to mineralization and as a result decreasing the level of bioactive components in this section. Although deer antler velvet is a natural source of IGF-1, Cox et al. identified human IGF-1 in four commercially available deer antler velvet products sold as "all natural" supplements. It should be noted that human IGF-1 shares the same sequence with other animals such as pigs, cows, and dogs. The IGF-1 from these animals could have been added to the supplement rather than a synthetic protein produced by recombinant methods (Cox & Eichner, 2013). However, the potential adulterated nature of these supplements and the absence of regulation by the Food and Drug Administration (FDA) should be something contemplated by the elite and recreational athlete before consumption.

Antler Velvet and the Immune System

The use of antler velvet to augment the immune system has been used in traditional Chinese medicine for over 2,000 years (Dai et al., 2011)(Kuo et al., 2012)(Kang et al., 2006)(Kim et al. 2004). However, there is still little research that identifies the bioactive

components associated with the immunomodulatory effects. One study attempted to identify an immunomodulatory in antler velvet, suggesting this component was phosphatidylcholines. The results were not consistently reproducible due to experimental conditions, concentrations, and species of phosphatidylcholines (Kim et al. 2004). Although the bioactive component in antler velvet has not been conclusively reported, many other studies have found immunomodulatory effects with antler velvet supplementation.

Staphylococcus aureus is a pathogen that can cause serious infections at the skin and soft tissue as well as the blood stream, including pneumonia or bone/joint infections. Dai et al. found the number of S. aureus pathogens in the peritoneal lavage fluid and kidney were significantly ($p<.05$) lower in mice treated with varying dosages of velvet antler when compared to those of control mice. In the same set of S. aureus-infected mice, ones who received pretreatment of antler velvet supplementation had significantly lower levels of inflammatory cytokines, interleukin 6 (1,000pg/$^{ml-}$1) and transforming growth factor beta 1 (300pg/$^{ml-}$1) ($p<.05$). This data suggests antler velvet supplementation inhibited the production of proinflammatory cytokines (Dai et al., 2011).

Deer antler velvet has also been attributed to preventing allergic and asthmatic effects. Serum immunoglobulin E (IgE) is a type of antibody the immune system overproduces when an allergen is present. IgE is the most important clinical biomarker for allergic responses (Kuo et al., 2012). Supplementation with antler velvet powder was able to significantly inhibit the increase in serum level of IgE ($p<.01$) for allergic airway sensitized mice at 21 days (.6 unit/ml) and 28 days (1.0 unit/ml). The reduction in serum IgE is believed to relieve the allergic symptoms by mediated mast cells.

Recently many studies have focused on the use of antler velvet as a treatment for diseases, such as rheumatoid arthritis and osteoarthritis (Kang et al., 2006)(Allen et al. 2002)(Allen et al. 2008)(Moreau et al. 2004). Patients with rheumatoid arthritis often seek complimentary medications or supplements in an attempt to find symptom in relief (Allen et al. 2008). Rats with type 2 collagen-induced arthritis that received deer antler extract (43±7.2) at varying dosages had a significantly lower severity ($p<.05$) of arthritic scores in comparison to the placebo group (90±9.6), these severity scores were also dose-dependent (Kang et al., 2006). Allen et al. focused on whether or not elk antler velvet could be taken concurrently with a variety of traditional rheumatoid arthritis medication and results showed no significant adverse effects at dosages of 2,4 or 6 capsules of 215mg. After 6 months of supplementation there were no statistically significant differences on any outcome measures when comparing the elk velvet antler groups and placebo (Allen et al. 2008). A possible rationale for this lack of consistent statistical findings between the rat and human studies could be due to higher dosage given to rats relative to body weight. In another animal model testing the effect of antler velvet as a treatment for osteoarthritis in dogs, the intervention group received 2, 3 or 4 capsules of 280mg per day, based on overall weight (Moreau et al. 2004). A dog weighing 60-79.9kg received 1,120mg of antler velvet per day, which in comparison to the previous study by Allen et al. was substantially more than some human participants were consuming. Results showed that after 60 days of oral consumption vertical ground reaction force (GRF) peak and craniocaudal GRF peak significantly improved. Correspondingly, owner's assessments of activity performance scores significantly improved pre to post-treatment and in comparison to dogs that received placebo only (Moreau et al. 2004).

Antler Velvet Improving Cardiovascular Function

Congestive heart failure is a condition in which the heart does not circulate blood in the body as efficiently as it should. In spite of the fact that there is no such term as "heart failure" in traditional Chinese medicine, deer antler velvet has been used to treat symptoms associated with heart failure for thousands of years (Shao et al., 2012). These symptoms can be classified as labored breathing, palpitation, and edema. Left coronary artery litigation is used in animal models mimic myocardial infarction and heart failure. Shao et al. investigated the therapeutic effects of antler velvet versus captopril on rats with heart failure following myocardial infarction. This study found that antler velvet and captopril failed to reverse the effects of myocardial infarction on structural parameters ($p>.05$). However, results did indicate that both treatments partially reversed the effect of functional damage (antler velvet-13.40±2.91, control-9.11±2.62) caused by myocardial infarction. Supporting the belief that antler velvet shows comparable therapeutic effects with captopril, and could be used concurrently with medications to treat heart failure (Shao et al., 2012).

Antler Velvet and Disease Recovery

Traditionally used as a tonic, antler velvet has also been considered to possess bone strengthening properties and used in therapy for bone diseases such as avascular necrosis (Shi et al., 2010). Avascular necrosis is a disease that causes bone tissue death due to lack of blood flow to the area. In rats with corticosteroid induced avascular necrosis, treatment with antler extract for 60 days promoted osteoblast proliferation. The observation of the femoral head using transmission electron microscope showed after treatment with antler extract, the cells of the femoral head were gradually recovering at a dose-dependent rate. In rats fed 800mg/kg of antler

extract, the degree of necrosis was significantly reduced (0.14±.01) ($p<.05$) in comparison to the model group (Shi et al., 2010). These results show that antler extract had a positive effect treating avascular necrosis by stimulating metabolism of bone cells and further promoting proliferation of osteoblasts.

Although cell proliferation is beneficial for a bone disease like avascular necrosis, it would be contraindicated with a disease like cancer. Fraser et al. focused on whether or not orally consumed deer antler velvet would promote colon cancer growth. Colon cancer was selected because it is a common type of cancer in Western countries with men and women evenly affected. Since deer antler velvet is generally consumed orally, it could potentially result in the release of various angiogenic factors across the gut leading to enhanced growth of cancerous tumors. Upon autopsy of colon cancer induced rats, results showed that when comparing the control and antler velvet treatment there was no statistically significant difference in volume of tumors (Fraser et al., 2010). Therefore, deer antler velvet did not stimulate the proliferation or metastasis of cancerous cells in the colon. Results showed that rats treated with deer antler velvet had a greater portion of lower grade colon tumors ($p<.03$) and for total tumors ($p<.0001$) compared with control rats (Fraser et al., 2010). These findings are important because they suggest deer antler velvet decreased the severity of pathologies, when previously it was believed that treatment would result with in an increase in severity.

Antler Velvet and Sexual Function

Late-onset hypogonadism (LOH) is associated with advancing age characterized by hypogonadal symptoms and low testosterone levels (Zang et al., 2015). In recent years, testosterone replacement therapy has been used to relieve symptoms in men with LOH (Zang et

al., 2015). Despite its recurrent use, testosterone replacement has side effects that cannot be ignored, often times leaving men with LOH searching for an alternative treatment. The reputation for improving sexual energy has resulted in antler velvet being used as an aphrodisiac (Conaglen et al. 2003). Zang et al. focused on whether the consumption of antler velvet could enhance the level of testosterone and improve sexual function in aging male mice. Mice were separated into three groups treated at different antler velvet dosages of 100, 200, or 300mg/kg a day, there was also a placebo group. At a dose of 200mg/kg, testosterone level ($9ng/ml^{-1}$) increased significantly ($p<.05$) in comparison to the placebo group, as well as the frequency of mount ($p<.05$) (Zang et al., 2015). Significant differences were not found with the two other dosage groups. These results show that the administration of antler velvet could improve sexual function as a byproduct of increasing testosterone level.

In a similar study focusing on deer antler velvet and sexual function in aging men Conaglen et al. found no significant differences in hormone levels after supplementation with antler velvet. After 12 weeks of supplementation with deer antler velvet at 1,000mg/day there were no significant changes in free testosterone and total testosterone levels. Self-reported scores on the International Index of Erectile Dysfunction and overall satisfaction were lower in the deer antler velvet group than in the control group (Zang et al., 2015). The variability in response between the two studies could be a result of how the antler velvet is collected and processed. It should be understood that different batches could have varying levels of composition, concentration and content.

Antler Velvet and Cell Growth/Tissue Remodeling

Antler velvet has been attributed to containing growth factor components, which are other naturally-occurring substances that contain growth factors proven efficient in enhancing cell growth and wound repair (Mikler et al. 2004). Sunwoo et al. found that the addition of water-soluble extract significantly promoted the growth of fibroblasts (40x104 cells) in cultured bovine skin, in a dose-dependent manner supporting the presence of growth promoting components in the antler velvet. Fibroblasts are a type of cell that synthesize the extracellular matrix and collagen playing a critical role in wound healing (Sunwoo et al. 1997). To expand on this study, Mikler et al. made full-thickness wounds in rats with diabetes, and a topical placebo gel or antler velvet gel was applied immediately after and days following the incision. The antler velvet group had significantly smaller wounds at day 6 (50% of initial wound) and 7 (40% of initial wound) in comparison to the placebo ($p<.05$), there was also a trend towards decreased inflammation in the antler treatment group at 2 days' post-incision. These results indicate that antler velvet may accelerate second intention wound healing in patients with diabetes (Mikler et al. 2004).

Antler Velvet and Performance Enhancement

Antler velvet is most commonly used as a performance-enhancing supplement, with proposed benefits on fatigue resistance, muscular endurance, muscular strength, and aerobic performance. The research into these effects has increased in recent years but results have been controversial. Broeder et al. found that after supplementation with New Zealand deer antler velvet the 1-RM values increased significantly both in absolute and relative terms to total body weight. There was also a significant improvement in aerobic capacity by 9.8% from pre to post-

treatment period (p=.002)(Gilbey & Perezgonzalez, 2012)(Broeder et al., 2004). Sleivert et al. used 6-RM and isokinetic knee extensor strength as a measurement of muscular strength and found no statistical difference between the placebo group and antler velvet intervention group for 6-RM. Yet, there was a statistically significant difference found for isokinetic knee extensor strength between the two groups (30±21% vs. 13±15%, p=.04). Dissimilar to findings by Broeder et al. there was no endocrine, red blood cell mass or VO_{2max} changes in either group (Sleivert et al., 2003) (Gilbey & Perezgonzalez, 2012). These varying results in muscular strength and aerobic capacity could be a result of substantial difference in antler velvet dosage between the two studies, with Sleivert using 1500mg/day and Broeder using 1350mg/day. In another study that dosed 1350mg/2xday, participants who were given the intervention significantly increased their VO_{2max} score pre to post (9.8%) (p<.05) (Earnest et al., 2015). However, in this same study there were no changes in anaerobic power, muscular strength or hematologic variables (Earnest et al., 2015).

To determine the anti-fatiguing factor attributed to deer antler velvet supplementation, the swimming capacity of mice was studied using a forced swimming test. During the test mice were judged to be fatigued when they failed to rise to the water's surface within 8 seconds (Chen et al. 2012). After antler velvet administration the swimming time (22 min vs. 16 min) increased significantly when compared to the control group (p<.05) (Chen et al. 2012)(Jang et al., 2014). Mice were being dosed antler velvet at equivalent to human dosages. There were no significant differences in blood glucose or lactate levels between the groups' post forced swimming test (Jang et al., 2014). Results also indicated slight reductions in fatigue-related blood biochemical parameters (BUN and LA), but never reached statistical significance (Chen et al. 2012). The reasoning as to how antler velvet decreases fatigue is not conclusive, it could

be a result of decreasing biochemical parameters or upregulating the genes associated with muscle strength (Chen et al. 2012).

Syrotuik et al. focused on the effect of antler velvet supplementation on rowers, specifically looking at resting and exercise-stimulated hormones in men and women. Rowing being a predominately muscular endurance sport could, in theory, benefit from the anti-fatiguing effect of antler velvet. The main findings indicated that 560mg of antler velvet did not alter any measured hormonal or physiologic response (serum growth hormone, serum cortisol) when compared to the placebo group. This lack of any significant findings could be due to the fact that mice usually receive higher dosages than human participants, the exact dosage needed to elicit a response is not known and could be a major limitation to these studies (Syrotuik et al. 2005).

CHAPTER 3- MATERIALS AND METHODS

Purpose

The purpose of this study was to examine the effect of deer antler supplementation on IGF-1 levels. It is hypothesized that seven days of deer antler sublingual supplementation will increase IGF-1 levels.

Design

Randomized, double-blinded longitudinal trial.

Participants

Twenty-eight UNLV students (13 females, 15 males) between the ages of 18-45 volunteered to participate in this study. A G power analysis was used to determine a sample size of 24 participants, to provide statistical significance when using a repeated measures ANOVA (within-between interaction). Effect size was set at f= 0.25, with alpha set at .05 (Earnest et al., 2015). Inclusion criteria: men and women between the ages of 18-45, who were considered normal weight, healthy adults (BMI= 20-24.9kg/m^2) or obese adults (BMI>30kg/m^2). Exclusion criteria included: collegiate level athletes, individuals who participate in activities where they may be drug tested as well as individuals who are drug tested for work. These individuals were excluded due to the lack of regulation by the FDA in supplementation concentration and processing. Women who were or thought they may be pregnant were excluded due to potential risk of hormonal imbalance. Participants were randomly assigned to the deer antler velvet intervention or placebo intervention. Prior to data collection participants signed an informed consent form.

Table 1. Descriptive Characteristics for female (n = 10) and male (n = 12) participants. The variance measure is standard deviation.

	Age	Body Mass	Height
Females	25.3±5.85	69.18±16.05	164.84±6.15
Males	25.41±4.42	92.48±15.45	180.84±8.26
p-value	.479	.001*	.00002*

*statistically significant

Recruitment

Participants were recruited by word of mouth from university courses.

Procedures

Upon arrival for the first scheduled visit to the Exercise Physiology Lab, the study procedure was explained to the participants. Procedures were approved by the Institutional Review Board (IRB #1180773-3) in advance and informed consent was obtained from all participants. Participants were allowed to ask questions regarding the study, and informed they could withdrawal from the study at any time without consequences. Anthropometric data such as age, height, gender, body mass, body fat/lean tissue mass were estimated and recorded (see procedures below). Participants were also instructed to complete a 24-hour food recall log, and answer a questionnaire regarding their activity level and average dairy consumption. Once all participants had completed the first visit, anthropometric data and the activity/dairy questionnaire were taken into consideration to match the participants. There were no significant differences ($p<.05$) between the matched pairs for fat-free mass, activity level and dairy consumption (Table 2). The participants and the matched pair were than randomly assigned into the deer antler velvet (Tonic Apothecary, Bend, OR) intervention or the placebo intervention. The placebo consisted of wheat flour, corn starch, and brown sugar in vegetable capsules.

Table 2. T-test p-values for matched pairs examining fat-free mass, activity level and dairy consumption.

	Fat-Free Mass Index	Average Exercise (week)	Average Dairy Consumption (day)
Deer Antler Velvet	19.89±3.19	4.36±0.92	1.27±0.82
Placebo	19.91±2.99	4.64±0.92	1.41±0.80
p-value	.491	.248	.348

Prior to arrival for the second visit, participants were advised to fast for 10 hours, and to avoid any vigorous exercise the morning of. Blood was drawn using the finger stick method, it was then centrifuged and plasma was placed in a freezer located in the Exercise Physiology Lab for storage at -70 degrees Celsius. After the finger stick, participants were able to eat snacks that were provided. During this time, the participant met with a different lab assistant and received the supplement they would be taking as well as instruction on how it should be consumed. This was done to maintain the double-blind nature of the study design. Both groups were instructed to consume two 500mg capsules twice a day. When consuming the capsule participants were instructed to bite the capsules and place them under the tongue and hold this for 60 seconds. Once the 60 seconds had elapsed, they were instructed to swallow the capsules with a drink. Before departure from the laboratory, the participant was instructed to go about their life as usual, exercising and eating like they normally would.

Prior to arrival for the third visit, participants were again advised to fast for 10 hours, and to avoid any vigorous exercise the morning of. The procedure for the third visit was similar

to that of the second visit, the only difference being participants no longer needed to meet with a lab assistant following the blood draw.

Data Collection

Data were collected using a finger stick method pre and post-supplementation. Post-supplementation blood draw was taken following the same procedures as pre supplementation. Participants were scheduled to come in at a similar time of day in comparison to pre testing, they were also instructed to fast for 10 hours and to avoid participating in exercise the morning of testing. Anthropometric data were collected using a SECA medical body composition analyzer (seca mBCA514, Chino, CA). When using the SECA, participants were asked to give their activity level, waist circumference, height and weight, this data was then saved and used to create a login on the machine. Participants then were instructed to stand and place their bare feet on the two foot electrodes, while placing their fingers on the hand electrodes. Once the body composition analysis ended, body fat percent and total lean body mass was recorded in an excel spreadsheet. Information about participant dairy consumption and activity level were collected using a 24-hour food recall log, and an activity/dairy questionnaire, these answers were recorded in Microsoft Excel version 15 (Redmond, WA).

IGF-1 levels were analyzed using two Human IGF-1 ELISA kits, manufactured by LifeSpan BioSciences,Inc (Catalog No. LS-F5067, Seattle, WA). Pre supplementation blood samples were analyzed on one ELISA plate, while post-supplementation blood samples were analyzed on another. Procedures strictly followed the manufactures instructions. A summary of the assay procedure is as follows: 1. Prepare all reagents, samples and standards, 2. Add 100µl of sample, standard, or blank to each well and incubate for 1 hour at 37°C, 3. Aspirate and add

100µl of Detection Reagent A and incubate for 1 hour at 37°C, 4. Aspirate and wash 3 times, 5. Add 100µl of Detection Reagent B and incubate for 30 minutes at 37°C, 6. Aspirate and wash 5 times, 7. Add 90 µl of TMB Substrate solution and incubate for 10-20 minutes at 37°C, 8. Add 50 µl of Stop Solution, 8. Read immediately at 450nm.

Data Analysis

The independent variable includes two levels; intervention and placebo group. The dependent variable is IGF-1. Data was analyzed using SPSS version 24 (IBM SPSS, Armonk, NY) statistical significance was set at $p < .05$ and a confidence interval of 95%. An independent t-test was used to determine the difference in IGF-1 measurements post-supplementation between the two groups. A Pearson's correlation test was run to analyze the relationship between post-supplementation IGF-1 levels and fat-free mass. A separate Pearson's correlation test was run to analyze the relationship between post-supplementation IGF-1 levels and average dairy consumption.

CHAPTER 4-RESULTS

Twenty-two (10 females, 12 males) of the twenty-eight participants were utilized for data analysis (Table 1). Two participants (1 female, 1 male) data was unable to be analyzed due to participant numbers and the inability to match them to a participant of the same sex. Two participants were unable to make it to the third visit for varying reasons, therefore the data for these participants and the matched participants were unable to be used for analysis. Due to IGF-1 concentrations falling outside of the standard curve on one ELISA plate, pre supplementation IGF-1 samples were unusable for all participants in the data analysis. As a result of high optical densities on the pre supplementation plate, seven concentrations were calculated at zero (Appendix A). The average coefficient of variation for the pre-supplementation plate was 8.47% and the post-supplementation plate was 4.9%. However, post-supplementation IGF-1 levels between the deer antler velvet and placebo group were viable for analysis.

An independent t-test looking at IGF-1 levels revealed no statistically significant difference (deer antler velvet- 0.56 ± 0.20, placebo-0.44 ± 0.09, p=.094) post-supplementation between the deer antler velvet and placebo groups. There was no significant correlation (p=.113) between fat-free mass index and IGF-1 levels (Table 3). There was also no significant correlation (p=.254) between average dairy consumption and IGF-1 levels (Table 3).

Table 3. Correlation between IGF-1 and fat-free mass, and IGF-1 and dairy consumption using all participant's data for analysis (n=22).

	IGF1/Fat Free Mass	IGF1/Dairy Consumption
r	-.269	.149
P-value	.113	.254

Since, there was no significant correlation found between IGF-1/fat-free mass and IGF-1/dairy consumption using all the participants compiled data, the correlations were broken down further to possibly extract concealed correlations. To see if there was a partial correlation supporting findings by Crowe et al. and Rasmussen et al. the correlations were separated under three conditions: sex, BMI, and dairy consumption (Table 4). When the data was broken down between high (BMI >30 kg/m^2) and low BMI (BMI 20-24.9 kg/m^2), there was a statically significant positive correlation (p=.006) in the high BMI group between IGF-1 and dairy consumption. There are many outside factors that could contribute to this correlation. Further examining this data showed that the top three participants setting this positive correlation had relatively low fat mass index's in comparison to their fat-free mass index's. Meaning the participants were relatively lean tissue mass dominant and they all participated in resistance training at least 4x a week. It is reasonable to consider that this correlation could be effected by their activity level. Another possible outside cause for this correlation could be the amount of food the participant's intake. If these participants were to be vigorously exercising at least 4x/week, their caloric intake would need to increase. Therefore, they could be consuming more dairy as well as other foods, for example red meat, which can also increase IGF-1 levels.

Table 4. Correlations further broken down by sex, BMI and dairy consumption.

		IGF1/FatFreeMass	IGF1/DairyConsumption	IGF1/BMI
Females	r	-.267	.324	-.164
	P-value	.228	.180	.325
Males	r	-.187	.154	-.287
	P-value	.281	.317	.183
High BMI n=12	r	.010	.698**	
	P-value	.488	0.006**	
Low BMI n=10	r	-.326	-.108	
	P-value	.179	.383	
Dairy Servings 1<	r	-.044		.035
	P-value	.455		0.464
Dairy Servings 1>	r	-.415		-.350
	P-value	.079		0.121

CHAPTER 5-DISCUSSION

The purpose of the current study was to determine if one week of sublingual capsular deer antler velvet supplementation increases IGF-1 levels in humans. This study found that there was no difference in IGF-1 levels between interventions after one week of supplementation and further concluded that fat-free mass and dairy consumption was not correlated with IGF-1. It was hypothesized that deer antler velvet supplementation would increase levels of IGF-1 post intervention. It was hypothesized that participants with a higher fat-free mass index would have a positive correlation to levels of IGF-1. It was also hypothesized that participants with higher dairy consumption would have a positive correlation to levels of IGF-1. To see if there was a partial correlation supporting the findings of Crowe et al. and Rasmussen et al. the data was broken down by covariates: sex, BMI, and dairy consumption. When the data was broken down between low and high BMI, a positive correlation was found in the high BMI group between dairy consumption and IGF-1 levels.

The limited amount of research on deer antler velvet has equivocal results, likely because of this ingestion method and exact dosage needed to elicit a response is not known. In studies by Broeder et al. and Earnest et al. performance-enhancing effects were seen with oral consumption of deer antler velvet capsules with dosages between 1350mg/day-2700mg/day for 10 weeks. Both studies recruited men between the ages 18-35 who had at least 4 years of resistance training. Primary outcome measures included maximum aerobic capacity, maximal

strength, and anaerobic cycling power. Both studies results suggested that deer antler velvet may have a positive effect on strength/power in men undergoing resistance training(Broeder et al., 2004)(Earnest et al., 2015). Based on these studies 2,000mg/day of deer antler velvet was selected in the present study to elicit an increase in IGF-1 levels. To the best of the researcher's knowledge, the current study is the first in literature to examine sublingual consumption of deer antler velvet and IGF-1 in a human population. In opposition to the studies conducted by Broeder et al. and Earnest et al. sublingual/oral consumption of the deer antler velvet capsule was chosen due to the fact that IGF-1 cannot absorbed through the digestive system before it is degraded by stomach acid. In this study, sublingual deer antler velvet supplementation was not found to increase IGF-1 levels.

The lack of increase in IGF-1 levels could be a result of an insufficient dosage, or the timing of the measurement. Participants were instructed to arrive to the blood draw fasted for 10 hours, since there is no research about the absorbency or half-life of deer antler velvet the window to measure IGF-1 in the plasma could have been missed. Alternatively, the lack of increase could be a result of how the supplement was consumed in capsular form. Previous studies have predominately used capsular delivery of the supplement, and these studies were used as a model when creating the procedures for this study. The current study recognizes the possibility that deer antler velvet extract could be a more efficient form for sublingual consumption in comparison to a capsular form. However, there has been no research to confirm this assumption and is a possible question to research in the future. The final possibility is that deer antler velvet may not increase IGF-1 levels as previously advertised, and the results from this study substantiate this theory.

Another purpose of this study was to identify if fat-free mass and dairy consumption were positively correlated to IGF-1 levels. When the data was analyzed intact, in both cases there was no statistically significant correlation to IGF-1. However, when the data was broken down between low and high BMI, for the high BMI group there was a statistically significant positive correlation between dairy consumption and IGF-1. These results support the findings of Crowe et al. who found that IGF-1 positively correlated with dairy protein/calcium consumption, and Rasmussen et al. who found that IGF-1 was inversely correlated to obesity (Crowe et al., 2009). The top three participants in the positive correlation had high fat-free mass and low fat mass measurements, with high dairy consumption. Therefore, these findings support the idea that fat mass is inversely correlated to IGF-1 levels as well as dairy consumption being positively correlated.

One possible explanation as to why the current studies intact result may have varied from Crowe et al. is the method for determining dairy consumption. In the current study a 24-hour food log was utilized as well as a questionnaire asking the participants to estimate their daily consumption based on a serving chart. Crowe et al. used country-specific validated dietary questionnaires the year before recruitment. The estimated intake was calculated by multiplying the nutrient content of a specific portion of food by the frequency of consumption, which could have led to a more accurate categorization for each individual.

Another possible explanation is sample size. Since half of the data collected for the current study was unusable, a repeated measure ANOVA statistical analysis could no longer be utilized. A second G power analysis was run; effect size was set at .76 with an alpha of .05. For our data to have power, the total sample size would have needed to be 44 participants. Unfortunately, the current study's data was underpowered. In comparison Crowe et al. had a

substantially larger participant number (n=4,731) which could have led to their statistically significant positive correlation.

Based on the finding that obesity was inversely correlated to IGF-1 by Rasmussen et al. it was assumed for the current study that fat-free mass would be positively correlated to IGF-1. The results from this study did not support a correlation between fat-free mass and IGF-1. Similar to Crowe et al., the study conducted by Rasmussen et al. had more participants (n=61) than the current study and this could be a reason as to why the results varied (Rasmussen, 1994). However, there was a significant correlation when the data was split by high and low BMI. The participants at the high end of this correlation had low fat mass measurements which supports the inverse correlation found by Rasmussen et al.

Limitations

There were multiple limitations within the study. A substantial limitation faced in this study was the unusable data for pre supplementation IGF-1 levels. The data became unusable for analysis as a result of the optical densities for a large portion of wells on one ELISA plate falling outside the standard curve. As a result, the calculated concentrations for each participant were extremely high and in some cases were not able to be calculated. The difference in optical densities between the two plates does not appear to be a byproduct of neglecting a step or misusing reagents or standards. Both ELISA plates were performed simultaneously, with kit components from each plate being mixed together and then pipetted into the wells. It appears that the one ELISA plate containing pre supplementation samples was more sensitive at detecting IGF-1 in comparison to the second plate. Not being able to use data collected before

supplementation limited the inferences that could be gathered between the two groups and for individual's pre-post levels.

Another limitation in this study was that both ELISA plates did not have a defined gradient within the standard curve. This made it difficult to calculate accurate concentration levels. Taking into consideration the conceivable sensitivity variance between the plates and the standard gradient deficit, the overall quality of the brand of ELISA kits was unsatisfactory. The last limitation to this study was that it cannot be accurately concluded whether or not all participants completed the 7 days of supplementation.

Conclusion

This study did not identify a difference in IGF-1 levels post 7-day supplementation between deer antler velvet and placebo groups and did not find a meaningful correlation between dairy consumption or fat-free mass and IGF-1 levels. Nonetheless, these findings are still valuable seeing that this is the first study to the researcher's knowledge that has focused mainly on examining the delivery method associated with the supplement. This study also adds to the very limited research on deer antler velvet. In the future this study could provide information needed to facilitate dosing that elicits performance-enhancing effects. Future research should focus on the form of the supplement and how it is consumed as well as examining other blood biomarkers that are associated with performance-enhancing effects.

APPENDIX A- IGF-1 ELISA ANALYSIS

ELISA Plate 2:

elisaanalysis.com

Assay ID	Kit Target	Kit Product Code	Created Date	Regression Algorithm
	IGF1		2018-04-11 03:49:15	4-Parameter Logistic Regression

» Find out more about the formulas (http://elisaanalysis.com/knowledge-base/elisa-software-4-parameter-logistic-4pl-nonlinear-regression)

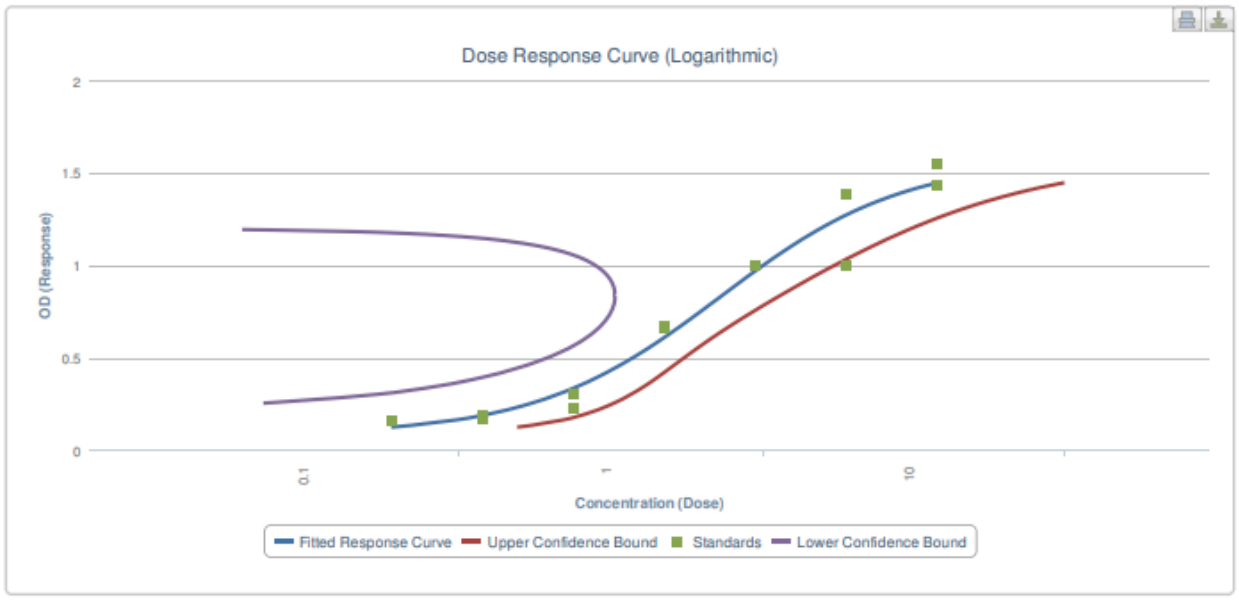
Regression Formula: $y = d + \frac{a-d}{1+(x/c)^b}$

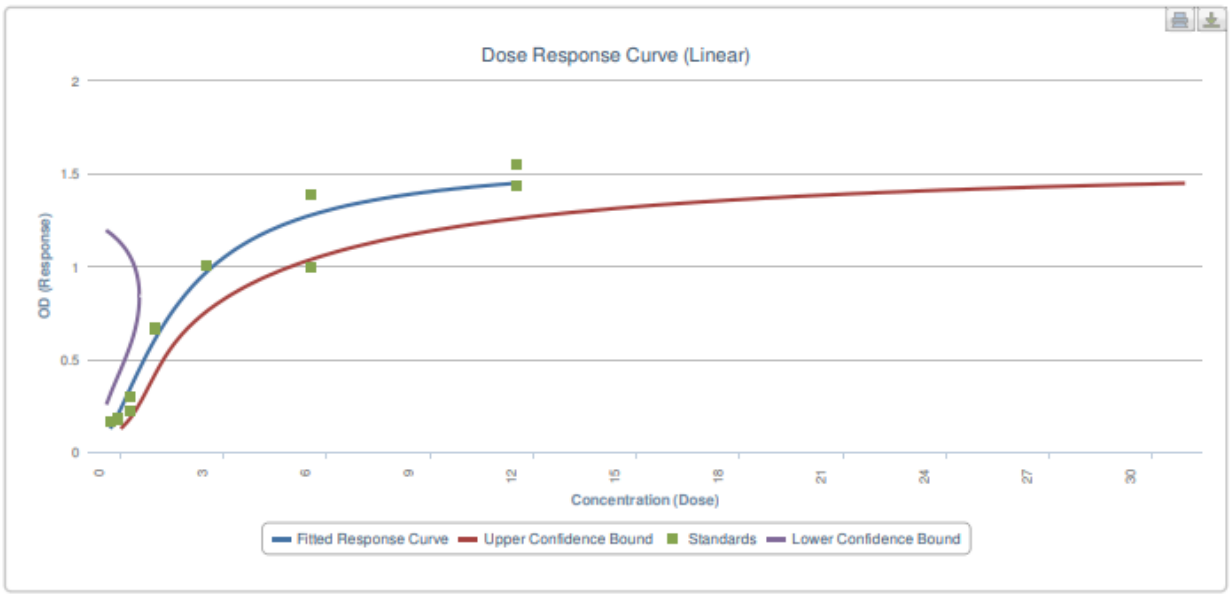
Inverse Formula: $x = c\left(\frac{a-d}{y-d} - 1\right)^{\frac{1}{b}}$

Where:
y = Response Value eg. OD
x = Dose Value eg. Concentration
and the constants/parameters are as follows:

a	b	c	d
1.5742333	-1.4251819	2.2923165	0.0820985

R^2 value: 0.9637731





Well Category	Well	Well Position	Well Optical Density	Mean Optical Density	Mean Concentration	Confidence Interval
Unknown	U1	A3,A4	1.012,1.132	1.072	3.734	0.694 - 6.687
Unknown	U2	B3,B4	1.17,1.236	1.203	5.008	-0.03 - 9.986
Unknown	U3	C3,C4	1.133,1.08	1.107	3.984	0.561 - 7.385
Unknown	U4	D3,D4	1.033,1.022	1.028	3.367	0.822 - 5.91
Unknown	U5	E3,E4	1.141,1.13	1.136	4.239	0.423 - 8.053
Unknown	U6	F3,F4	1.229,1.241	1.235	5.41	-0.335 - 11.152
Unknown	U7	G3,G4	1.355,1.128	1.242	6.021	-0.407 - 11.414
Unknown	U8	H3,H4	1.136,1.125	1.131	4.191	0.449 - 7.932
Unknown	U9	A5,A6	1.207,1.162	1.185	4.767	0.116 - 9.394
Unknown	U10	B5,B6	1.202,1.295	1.249	5.695	-0.487 - 11.708
Unknown	U11	C5,C6	1.228,1.27	1.249	5.636	-0.493 - 11.729
Unknown	U12	D5,D6	1.232,1.213	1.223	5.236	-0.208 - 10.673
Unknown	U13	E5,E6	1.464,1.229	1.347	9.419	-2.287 - 17.551
Unknown	U14	F5,F6	1.446,1.21	1.328	8.555	-1.817 - 16.118
Unknown	U15	G5,G6	1.46,1.266	1.363	9.524	-2.786 - 19.024
Unknown	U16	H5,H6	1.267,1.135	1.201	5.072	-0.014 - 9.919
Unknown	U17	A7,A8	1.112,0.899	1.006	3.321	0.872 - 5.57
Unknown	U18	B7,B8	1.055,1.025	1.04	3.455	0.79 - 6.116

Unknown	U19	C7,C8	1.32,1.27	1.295	6.461	-1.155 - 14.004
Unknown	U20	D7,D8	1.17,1.107	1.139	4.285	0.407 - 8.127
Unknown	U21	E7,E8	1.28,1.187	1.234	5.462	-0.319 - 11.093
Unknown	U22	F7,F8	1.005,1.028	1.017	3.294	0.848 - 5.737
Unknown	U23	G7,G8	1.283,1.166	1.225	5.371	-0.227 - 10.747
Unknown	U24	H7,H8	1.232,1.175	1.204	5.006	-0.035 - 10.002
Unknown	U25	A9,A10	0.918,0.945	0.932	2.789	0.983 - 4.592
Unknown	U26	B9,B10	1.033,1.049	1.041	3.461	0.788 - 6.133
Unknown	U27	C9,C10	0.378,0.209	0.294	0.647	0.153 - 1.142
Unknown	U28	D9,D10	0.384,0.253	0.319	0.711	0.207 - 1.213
Unknown	U29	E9,E10	0.332,0.241	0.287	0.63	0.139 - 1.121
Unknown	U30	F9,F10	0.381,0.199	0.29	0.638	0.146 - 1.132
Unknown	U31	G9,G10	0.202,0.174	0.188	0.377	-0.044 - 0.798
Unknown	U32	H9,H10	0.188,0.158	0.173	0.336	-0.065 - 0.738
Unknown	U33	A11,A12	0,0	0	0	No data
Unknown	U34	B11,B12	0,0	0	0	No data
Unknown	U35	C11,C12	0,0	0	0	No data
Unknown	U36	D11,D12	0,0	0	0	No data
Unknown	U37	E11,E12	0,0	0	0	No data
Unknown	U38	F11,F12	0,0	0	0	No data
Unknown	U39	G11,G12	0,0	0	0	No data
Unknown	U40	H11,H12	0,0	0	0	No data

Standard	S1	A1,A2	1.55,1.429	1.49	12	N/A
Standard	S2	B1,B2	1.387,0.993	1.19	6	N/A
Standard	S3	C1,C2	1,1	1	3	N/A
Standard	S4	D1,D2	0.668,0.66	0.664	1.5	N/A
Standard	S5	E1,E2	0.221,0.3	0.261	0.75	N/A
Standard	S6	F1,F2	0.17,0.184	0.177	0.375	N/A
Standard	S7	G1,G2	0.16,0.16	0.16	0.188	N/A

ELISA Plate 1:

elisaanalysis.com

Assay ID	Kit Target	Kit Product Code	Created Date	Regression Algorithm
	igf1		2018-04-12 04:40:26	4-Parameter Logistic Regression

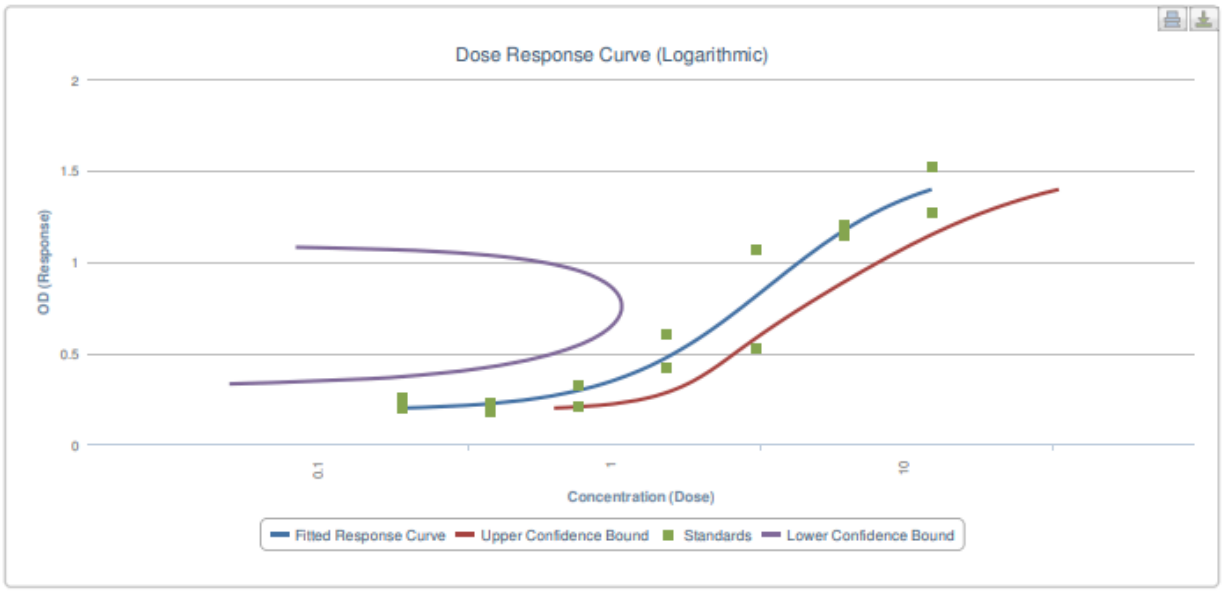
» Find out more about the formulas (http://elisaanalysis.com/knowledge-base/elisa-software-4-parameter-logistic-4pl-nonlinear-regression)

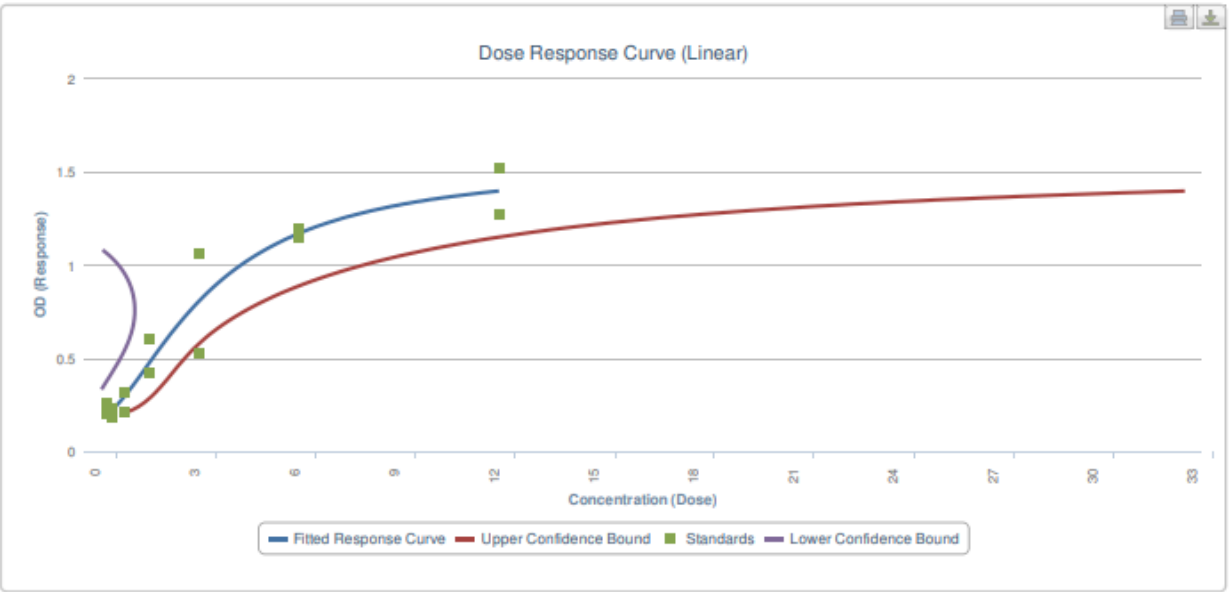
Regression Formula: $y = d + \frac{a-d}{1+(x/c)^b}$ **Inverse Formula:** $x = c(\frac{a-d}{y-d} - 1)^{\frac{1}{b}}$

Where:
y = Response Value eg. OD
x = Dose Value eg. Concentration
and the constants/parameters are as follows:

a	b	c	d
1.5440926	-1.6310478	3.3255692	0.1855486

R^2 value: 0.9303556





Well Category	Well	Well Position	Well Optical Density	Mean Optical Density	Mean Concentration	Confidence Interval
Unknown	U1	A3,A4	1.234,1.421	1.328	10.347	-4.519 - 22.95
Unknown	U2	B3,B4	1.5,1.684	1.592	13.329	No data
Unknown	U3	C3,C4	1.449,1.712	1.581	8.121	No data
Unknown	U4	D3,D4	1.477,1.54	1.509	68.499	-47.288 - 108.323
Unknown	U5	E3,E4	1.583,1.629	1.606	0	No data
Unknown	U6	F3,F4	1.604,1.701	1.653	0	No data
Unknown	U7	G3,G4	1.533,1.906	1.72	31.538	No data
Unknown	U8	H3,H4	1.393,1.622	1.508	5.946	-45.998 - 105.977
Unknown	U9	A5,A6	1.529,1.297	1.413	30.246	-10.431 - 36.642
Unknown	U10	B5,B6	1.566,1.271	1.419	3.875	-11.082 - 38.065
Unknown	U11	C5,C6	1.526,1.307	1.417	27.602	-10.839 - 37.535
Unknown	U12	D5,D6	1.698,1.377	1.538	5.545	-217.357 - 391.269
Unknown	U13	E5,E6	1.677,1.497	1.587	12.784	No data
Unknown	U14	F5,F6	1.598,1.482	1.54	10.714	-322.713 - 555.935
Unknown	U15	G5,G6	1.729,1.451	1.59	8.236	No data
Unknown	U16	H5,H6	1.63,1.364	1.497	5.261	-35.545 - 86.678
Unknown	U17	A7,A8	1.275,1.404	1.34	10.182	-5.05 - 24.26
Unknown	U18	B7,B8	1.583,1.457	1.52	8.604	-68.996 - 146.941
Unknown	U19	C7,C8	1.627,1.637	1.632	0	No data
Unknown	U20	D7,D8	1.693,1.999	1.846	0	No data
Unknown	U21	E7,E8	1.88,0.061	0.971	0	0.672 - 7.389
Unknown	U22	F7,F8	1.74,1.764	1.752	0	No data

Unknown	U23	G7,G8	1.789,1.511	1.65	15.974	No data
Unknown	U24	H7,H8	1.646,1.503	1.575	13.937	No data
Unknown	U25	A9,A10	1.449,1.135	1.292	10.907	-3.25 - 19.722
Unknown	U26	B9,B10	1.584,1.571	1.578	0	No data
Unknown	U27	C9,C10	0.25,0.675	0.463	1.434	0.504 - 2.381
Unknown	U28	D9,D10	0.303,0.213	0.258	0.546	-0.179 - 1.319
Unknown	U29	E9,E10	0.281,0.23	0.256	0.55	-0.186 - 1.3
Unknown	U30	F9,F10	0.235,0.374	0.305	0.766	-0.039 - 1.619
Unknown	U31	G9,G10	0.235,0.283	0.259	0.569	-0.176 - 1.327
Unknown	U32	H9,H10	0.238,0.301	0.27	0.619	-0.147 - 1.402
Unknown	U33	A11,A12	0,0	0	0	No data
Unknown	U34	B11,B12	0,0	0	0	No data
Unknown	U35	C11,C12	0,0	0	0	No data
Unknown	U36	D11,D12	0,0	0	0	No data
Unknown	U37	E11,E12	0,0	0	0	No data
Unknown	U38	F11,F12	0,0	0	0	No data
Unknown	U39	G11,G12	0,0	0	0	No data
Unknown	U40	H11,H12	0,0	0	0	No data
Standard	S1	A1,A2	1.27,1.522	1.396	12	N/A
Standard	S2	B1,B2	1.145,1.196	1.171	6	N/A
Standard	S3	C1,C2	1.06,0.526	0.793	3	N/A
Standard	S4	D1,D2	0.421,0.602	0.512	1.5	N/A
Standard	S5	E1,E2	0.21,0.318	0.264	0.75	N/A
Standard	S6	F1,F2	0.179,0.227	0.203	0.375	N/A
Standard	S7	G1,G2	0.258,0.196	0.227	0.188	N/A

APPENDIX B: INFORMED CONSENT (IRB #1180773-3)

UNLV

INFORMED CONSENT

Department of Kinesiology and Nutrition Sciences

TITLE OF STUDY: Change in IGF-1 Levels Pre-Post Supplementation with Deer Antler Velvet

INVESTIGATOR(S): Nicole Marmillo, Dr. James Navalta

For questions or concerns about the study, you may contact Dr. James Navalta (702)895-4672; Nicole Marmillo at **(702)-895-0996.**

For questions regarding the rights of research subjects, any complaints or comments regarding the manner in which the study is being conducted, contact **the UNLV Office of Research Integrity – Human Subjects at 702-895-2794, toll free at 877-895-2794 or via email at IRB@unlv.edu.**

Purpose of the Study

You are invited to participate in a research study. The purpose of these study is to determine whether or not deer antler velvet can be absorbed into the circulatory system after 7 days of sublingual consumption (i.e. under the tongue).

Participants

You are being asked to participate in the study because you fit this criteria: Adult between the ages of 18 and 45 years and your body mass index (BMI) must be between 20 and 24.9 kg/m^2 or over 30 kg/m^2. To know your BMI,
[https://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm]

Exclusion criteria:

- If you participate in work or other activities where you will be drug tested.
- Women who are or think they might be pregnant are not able to participate.

Procedures

If you volunteer to participate in this study, you will be asked to do the following:

- Come to the Exercise Physiology Laboratory for a total of three visits.
    - You will need to be fasted for 10 hours prior to each visit.

- Upon the first visit your height, weight, sex, and percent body fat/lean tissue mass will be measured.
- You will be asked to fill out a 24 hour food log, Dairy Questionnaire, and answer questions about how frequently you exercise.
    - You will then be randomly assigned into the placebo group or treatment group.
- Finger-stick blood draws of 600 microliters (approximately one-tenth of a tsp) will be obtained before (second visit) and after 7 days (third visit) of supplementation with deer antler velvet.
    - Your blood samples will be stored in the freezer until analyzed, and the remainder will be destroyed and properly disposed of.
- Supplementation dosage will consist of four 500mg capsules per day of deer antler velvet or placebo. The brand of deer antler velvet supplement and food label are provided below.
    - We will give you enough capsules to take over the 7-day period. We'll go through how to use them on the first day of testing.

- Deer Antler Velvet has been used in traditional Chinese medicine for 2,000 years with proposed benefits of increasing muscle strength and endurance, increasing aerobic capacity, stimulating the immune system and improving muscle recovery. This supplement is commercially available and can be purchased online, in grocery or nutrition based stores.

Benefits of Participation

There may not be direct benefits to you as a participant in this study. However, we hope to learn about quantification of deer antler velvets bioactivity in the circulatory system, which could further determine if the claims surrounding the usage of deer antler velvet are accurate.

Risks of Participation

There are risks involved in all research studies. This study may include only minimal risks. There is minimal risk of gastrointestinal (GI) discomfort that could lead to diarrhea, as well minimal risk of slight bruising to the finger pad due to the blood draw. Any distress associated

with this study should be reported to the primary investigator- Dr. James Navalta at (702) 895-2344 or by email james.navalta@unlv.edu.

Cost /Compensation

There may not be financial cost to you to participate in this study. The study will take approximately 1 hour of your time. You will not be compensated for your time. If you need a parking pass, please let us know and we will provide one.

Confidentiality

All information gathered in this study will be kept as confidential as possible. No reference will be made in written or oral materials that could link you to this study. All records will be stored in a locked facility at UNLV for 3 years after completion of the study. After the storage time the information gathered will be destroyed if that document contains identifiable information (e.g., name). Digital data will exist in de-identified form for a minimum of 3 years following study completion. After your blood samples have been analyzed, the remainder will be destroyed and properly disposed of.

Voluntary Participation

Your participation in this study is voluntary. You may refuse to participate in this study or in any part of this study. You may withdraw at any time without prejudice to your relations with UNLV. You are encouraged to ask questions about this study at the beginning or any time during the research study.

Participant Consent:

I have read the above information and agree to participate in this study. I have been able to ask questions about the research study. I am at least 18 years of age. A copy of this form has been given to me.

_____ _____

Signature of Participant Date

_____

Participant Name (Please Print)

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CURRICULUM VITAE

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Education

Master of Science in Kinesiology **Expected Summer 2018**
Athletic Training Concentration Advisor: James Navalta, PhD
University of Nevada Las Vegas
Thesis: Changes in IGF-1 Levels Post Deer Antler Velvet Supplementation

Bachelor of Science in Athletic Training **May 2016**
Massachusetts College of Liberal Arts
Graduated magna cum laude

Professional Experience

ACADEMIC

Graduate Assistant **August 2016-Present**
Department of kinesiology and Nutrition Sciences, University of Nevada Las Vegas

- Responsible for teaching 100-level lecture course, help with instruction of upper level courses in a lab setting as well as guest lecturing in upper level courses.
- Assist Athletic Training Program Director and Clinical Coordinator with tasks pertaining to the undergraduate athletic training program
- Help coordinate the application process for the undergraduate Athletic Training Program, as well as coordinate inventory and purchase orders for the undergraduate Athletic Training Program

COURSES TAUGHT

Department of kinesiology and Nutrition Sciences, University of Nevada Las Vegas

Graduate Student Instructor

- Sports Injury Management 101: Introduction to Athletic Training
- Sports Injury Management 386: Assessment and Evaluation of Lower Extremity Injuries Lab
- Sports Injury Management 480: Therapeutic Exercise Lab

Teaching Assistant/Guest Lecturer

- Sports Injury Management 102: Introduction to Athletic Training Clinical
- Sports Injury Management 371: Clinical Experiences in Athletic Training I
- Sports Injury Management 471: Advanced Clinical Experience in Athletic Training II
- Sports Injury Management 418: Advanced Athletic Training

CLINICAL

Athletic Trainer, Independent Contractor **September 2016-Present**

- Provide athletic training coverage for soccer, basketball, wrestling, track and field and lacrosse in Las Vegas

Licensed Athletic Trainer **June 2018 – August 2018**

Camp Greylock, *Becket MA*

- Employed at a preeminent summer sports camp working in the health center
- Camp Greylock is home to 400 boys ages ranging from 6 to 16, with a wide array of sports including: basketball, soccer, tennis, hockey, flag football, swimming, sailing, archery, mountain biking, baseball, golf and lacrosse.

Licenses & Certifications

Certified Athletic Trainer	Athletic Training Board of Certification
Licensed Athletic Trainer	Nevada State Board of Legislation
First Aid/CPR/AED	America Heart Association

Professional Memberships

National Athletic Trainers' Association 2013 – Present