

The Effects of *Lepidium Meyenii* on Grip Strength, Fatigue, and Sexual Behavior

Original Research

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Abstract

Introduction:

There are a variety of medicinal claims regarding the efficacy of maca. The aim of the current study was to examine the effects of maca on body composition, strength, mood, and sexual functioning

Methods: Forty-seven subjects consumed 2.1g of maca for 28 days. This study used a randomized, double-blind, placebo-controlled design. The Shapiro Test was used to test the effect of maca on grip strength, mood and sexual functioning. A Nonparametric Wilcoxon Rank Test was utilized to examine differences between the groups for men and women separately.

Results: Although females in the treatment group had significant differences from baseline, those differences were no longer significantly different when compared to the placebo group. Males in the treatment group showed significant improvements over the placebo group in fatigue (mean±SD: -3.3 ± 3.9 vs. 1.3 ± 6.2), handgrip (4.6 ± 7.5 vs. -0.4 ± 5.4), and sexual behavior (3.83 ± 4.3 vs. 0.7 ± 2.1).

Conclusions: Maca supplementation may lessen fatigue, improve strength, and enhance sexual functioning in otherwise healthy men.

Key Words: Sexual Functioning, Vigor, Maca

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Introduction

Maca (*Lepidium meyenii*) is a Peruvian plant that belongs to Bracaceae family. It is predominantly cultivated in the Central Andes at elevations of 3,500-4,500 meters above sea level. There are 13 different ecotypes which are characterized by the color of the plant's root [1]. Although it is believed to have high concentrations of protein, protein comprises only 8% of the root and 14% of the paste. The proteins are in polypeptide form: glutamate acid, syrian, lysine, argentine, valine, phenylalanine, tyrosine, and aspartic acid [2]. Maca is rich in sterols and contains linoleic, palmitic, and oleic acid. The carbohydrate content is quite high and similar to those of grains and wheat [1].

Domesticated maca has been grown in Peru for over 2,000 years and is a staple crop for natives of Peru [8]. It was first described as *Lepidium meyenii* by botanist Wilhelm Gerard Walpers in the early 1800s. In 1992, the Food and Agricultural Organization of the United Nations indicated that maca is a safe and edible food that should be consumed to prevent nutritional deficits [8]. However, it is typically used as a supplement rather than a food source. There are a variety of medicinal claims regarding the efficacy of maca. It has been linked to improvements in fertility, sexual functioning, energy, stamina, and physical performance [3,4,5,6,7].

Rats have commonly been used to study the influence of maca on fertility and sexual behavior. In one study, rats were given maca for 15 days at both low (15mg/kg) and high (75mg/kg) doses. First mounting, first intromission, ejaculatory latency, ejaculation latency, post-ejaculatory latency, intercopulatory interval, and copulatory efficacy were assessed at the time of first mounting. First intromission and intercopulatory interval were significantly decreased at both the lower and higher doses; however, only higher doses decreased post-ejaculatory latency. Additionally, there was an overall increase in general

activity after 15 days of maca [11]. Maca lipid extracts also increased complete intromissions and decreased the latent period erection of both rats and mice. Maca even aided in the sexual functioning of testes-removed rats who experienced improved erectile function and increased latent period of erection [8].

In addition to the aphrodisiac properties, maca has been shown to increase fertility in both humans and rats. Female rats exhibited an increase litter size and pregnancy rates. Male rats showed increased sperm counts and higher testicular weights [13]. Maca also prevented the reduction in sperm count induced by high altitudes [14]. In human males, maca led to increased sperm count and seminal volume. Most notably, mobile sperm count increased from 87.7×10^6 to 183.6×10^6 after consuming maca for four months [13]. However, a contradicting study indicated that maca may not improve fertility since it does not activate androgen receptors thus excluding a direct effect of androgens [15].

The use of maca as an aphrodisiac generated a resurged interest in this plant [4,6,8]. Gonzales et al. [16] conducted a double-blind, placebo-controlled study which found that 40% of men exhibited an increase in sexual desire after eight weeks of maca. Differing studies [17] found that maca was ineffective in improving blood flow in men who have erectile dysfunction.

Maca has also been gaining popularity as an athletic performance supplement [11]. Some evidence suggests that maca improves stamina and strength [9]. In a randomized, crossover, design study conducted by Stone et al. [9] participants completed a self-paced, 40km cycle test on a cycle ergometer. Although maca significantly improved cycling time when compared to the baseline test, it did not significantly improve time when compared to the placebo. Heart rate and perceived exertion were recorded at 5km intervals throughout the trail. There were no changes in either.

Cardiorespiratory endurance can be used as an indicator of anti-fatigue capability. In a study conducted by Li, et al. [10] mice were fed maca for 30 days and were forced to engage in a swimming test. Each carried a load weighing 7% of their body weight attached to their tail. Mice in the treatment group had significantly longer swimming times than mice in the placebo group. Moreover, maca's increase in exercise endurance became even more prevalent due to the dose-effect relationship.

Methods

Healthy volunteers were recruited for this study between October, 2017, and March, 2018. Sixty-three participants between the ages of 18 and 53 volunteered for the study. Sixteen did not return for the post-test. Five subjects failed to attend the post-test and did not respond to emails or phone calls. Four reported "a lack of time" to return. Three subjects (2 females, 1 male) in the treatment group reported an increase in acne. Three males in the treatment group experienced an increase in blood pressure, and one participant in the placebo group reported an increase in headaches. The resulting 47 subjects, 22 males and 25 females were split at a 1:1 ratio between the maca and placebo groups. Written informed consent was obtained from each participant prior to testing. Subjects were excluded if they were pregnant or had any hormone-sensitive conditions such as breast cancer, uterine cancer, ovarian cancer, endometriosis, or uterine fibroids. Only subjects who had engaged in sexual intercourse in the previous 28 days were included in this study. This study was approved by the International Review Board (IRB# 2017-565) at Nova Southeastern University.

Protocol

This study used a randomized, double-blind, placebo-controlled design that examined the effect of maca on grip strength, mood and sexual functioning. Participants were required to visit the body composition lab on two separate occasions for pre-and post-testing. Participants first signed the informed consent and then were randomized into either a treatment (25 subjects) or placebo group (22 subjects). Participants were instructed to ingest 2.1g of a maca-containing product (Nutrition21 proprietary maca blend - Lepidamax™) or a placebo each day for 28-days. Both maca and placebo were divided into three pills.

Body composition and Handgrip Strength

Anthropometric measurements consisted of height, weight, and body fat percentage. Height was assessed using standard anthropometry, and total body weight was measured using a calibrated scale. Body composition was measured by whole body densitometry using air displacement via the Bod Pod® (COSMED USA, Concord, CA). All testing was performed in accordance with the manufacturer's

instructions. Subjects were tested while wearing only tight-fitted clothing and an acrylic swim cap. The subjects wore the same clothing for the pretest and posttest. Data from the Bod Pod® includes body weight, percent body fat, fat free mass, and fat mass. All subjects were assessed at approximately the same time of day. Grip strength was tested in the dominate hand. The purpose of this test is to measure isometric strength of the hand and forearm muscles. Participants squeezed the Jamar hand grip device with their dominant hand, with his or her elbow at a 90° using maximal effort. Each participant had two trials and the highest strength value was recorded in kilograms.

Questionnaires

Participants filled out two questionnaires. The first was the Profile of Mood States (POMS), a 65-item multidimensional physiological rating scale used to assess transitory mood states. In addition to a total mood score, POMS subdivides mood into Tension, Depression, Anger, Vigor, Fatigue, and Confusion. The second survey was adapted from the Derogates Interview for Sexual Functioning (DISF- SR), which contains 26 questions separated into five domains: Sexual Cognition/Fantasy, Sexual Arousal, Sexual Behavior and Experience, Orgasm and Sexual Drive.

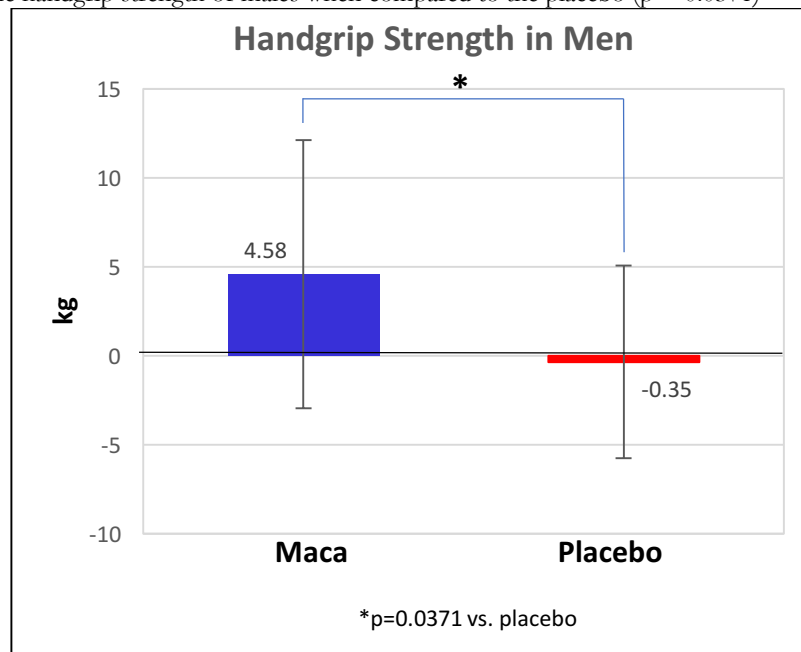
Statistical Analysis

Data were analyzed using SPSS software. All dependent variables were tested using the Shapiro test. The Nonparametric Wilcoxon rank-sums test was utilized to examine differences between the groups for men and women separately, based on the small sample size and the distribution of the data. For the efficacy variables tested, the goal was to establish whether the maca performed better than the placebo. Therefore, p-values from one-tailed tests were used to compare those variables. Differences were considered significant for the one-tailed P -value < 0.05 .

Results

Handgrip Strength

Chart 1 shows the changes in handgrip strength following a 28-day maca treatment. Maca significantly improved the handgrip strength of males when compared to the placebo ($p = 0.0371$)



Sexual Behavior

Chart 2 shows the change in sexual behavior following a 28-day maca treatment. Maca significantly improved the sexual behavior of males when compared to the placebo ($p = 0.0185$).

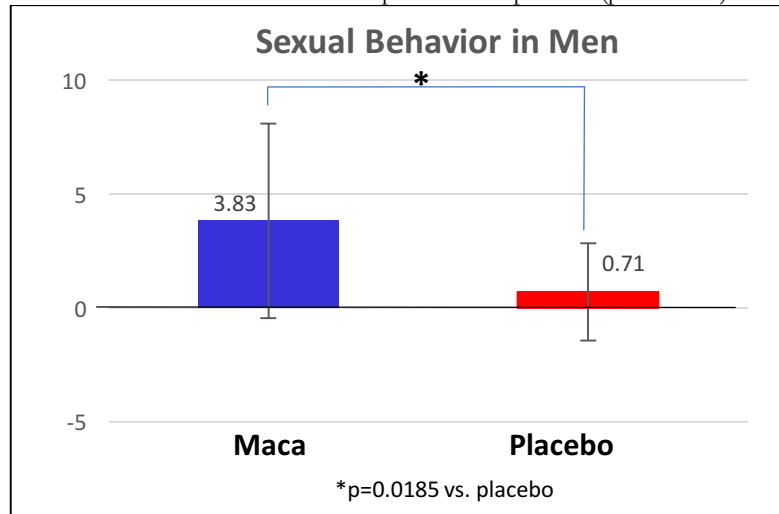
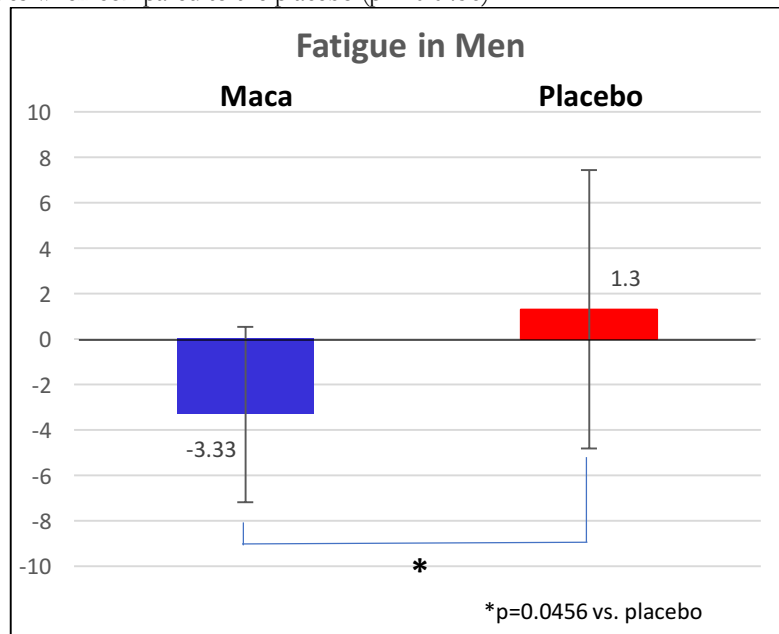
*Fatigue*

Chart 3 shows the change in fatigue following a 28-day maca treatment. Maca significantly improved fatigue in males when compared to the placebo ($p = 0.0456$).



There were no changes in body composition for either males or females. Although females in the treatment group had significant changes in fatigue, confusion, tension, orgasm and handgrip from baseline, those differences were not significant when compared to the placebo group.

Discussion

Indigenous Peruvians have been consuming maca for 2,000 years but it recently gained popularity as a supplement that can improve strength, energy, and sexual functioning [4]. Prior studies showed improvements in human strength but not when compared to the strength of the placebo group [5]. This study, however, indicated that men who consumed maca for 28-days had significantly higher handgrip scores when compared to the men who consumed the placebo. In the present study, maca was also shown

to improve fatigue and sexual functioning in comparison with the placebo. This is consistent with prior research [3,5,6,7].

Sexual dysfunctions have a negative impact on an increasing number of individuals due to the rise of obesity and the lowered rates of physical activity [18]. Sexual dysfunctions are present in 43% of women and 31% of men. Hypoactive sexual desire disorder (HSDD) defined as the persistent deficiency of sexual thoughts or fantasies, is prevalent in 32% of women and 15% of men [19]. Sexual function is vital to the well-being and quality of life. Currently, medicinal aids and synthetic testosterone are used to increase sexual desire in men. However, there are advantages of maca supplementation as a replacement to the pharmaceutical aids. Maca has less serious side effects than both testosterone and Viagra. Testosterone supplements may contribute to prostate cancer and should not be used with people who have normal testosterone levels [20]. Viagra only improves sexual desire in males with erectile dysfunction. Maca has minimal side effects and is available over-the-counter allowing patients to take control over their own therapeutic regimen without the embarrassment of consulting a prescribing physician [13].

It is unclear as to why maca was effective for men but not women. Some studies indicate that maca can cause changes in hormonal levels [5,20] while others indicate that serum testosterone and oestradiol levels are not different in men treated with maca [16]. Further studies need to examine maca's effects on testosterone levels and sex differences in maca treatment.

Limitations

This sample size consisted of predominately college students and may not be representative of the general population. Due to the sensitive nature of sexual behaviors, sexual functioning was self-reported. Thus, there is an inherent concern regarding the construct validity of self-report measures. However, if responses were exaggerated, they would be expected to be inflated across persons in both the treatment and placebo group.

Self-selection bias may have played a role since individuals who do not consider themselves physically fit, may avoid participating in a study that requires strength and body composition testing. Previous research indicates that those willing to participate in sex research may hold less traditional values about sex, may be more sexually experienced, and may report a higher sexual self-esteem [21]. Furthermore, in order for participants to answer all of the questions on the DISF they had to engage in sexual intercourse in the previous 28 days. Therefore, only those in a sexual relationship were included in the analysis.

Media-Friendly Summary

Maca has been grown in Peru for over 2,000 years but it recently gained popularity for its aphrodisiac properties. There are vast claims that maca is the “wonder herb” for fertility, sexual functioning, stamina, and athletic performance. The results show that maca may lessen fatigue, improve strength and enhance sexual functioning in men.

Acknowledgements: Maca was provided by Nutrition21. No funding was provided to conduct this investigation.

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