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A pilot investigation into the effect of maca supplementation on physical activity and sexual desire in sportsmen

Mark Stone[a,*], Alvin Ibarra[b], Marc Roller[c], Andrea Zangara[a], Emma Stevenson[a]

[a] School of Psychology and Sports Sciences, Northumbria University, Newcastle upon Tyne NE1 8ST, UK
[b] Naturex Inc, 375 Huyler Street, South Hackensack, NJ 07606, USA
[c] Naturex SA, Site d'Agroparc BP 1218, 84911 Avignon Cedex 9, France

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ABSTRACT

Aims of the study: Maca (*Lepidium meyenii* Walp) is consumed both as a sports supplement by strength and endurance athletes, and as a natural stimulant to enhance sexual drive. However, whether or not the postulated benefits of maca consumption are of scientific merit is not yet known. The aim of the study was therefore to investigate the effect of 14 days maca supplementation on endurance performance and sexual desire in trained male cyclists.
Materials and methods: Eight participants each completed a 40 km cycling time trial before and after 14 days supplementation with both maca extract (ME) and placebo, in a randomised cross-over design. Subjects also completed a sexual desire inventory during each visit.
Results: ME administration significantly improved 40 km cycling time performance compared to the baseline test ($P = 0.01$), but not compared to the placebo trial after supplementation ($P > 0.05$). ME administration significantly improved the self-rated sexual desire score compared to the baseline test ($P = 0.01$), and compared to the placebo trial after supplementation ($P = 0.03$).
Conclusions: 14 days ME supplementation improved 40 km cycling time trial performance and sexual desire in trained male cyclists. These promising results encourage long-term clinical studies involving more volunteers, to further evaluate the efficacy of ME in athletes and normal individuals and also to explore its possible mechanisms of action.

1. Introduction

Lepidium meyenii Walp (maca) is an annual or biennial herbaceous crop belonging to the Brassicaceae family, which has been grown and cultivated exclusively in the Junín plateau of Peru's Central Highlands for approximately 2000 years (Valentová et al., 2008).

Anecdotal evidence exists to suggest that consumption of maca improves stamina and strength, and can increase sexual drive and fertility in men (Cicero et al., 2001). One text has reported that as early as the 13th century, Inca warriors consumed maca prior to entering into battle in order to increase their energy, but that they were prohibited from its consumption following the conquest of a city, in order to protect women from the resultant increase in sexual desire (Quirós and Cárdenas, 1997).

Maca derivatives are gaining popularity as dietary supplements consumed either to enhance sexual desire or athletic performance (Gonzales et al., 2002; Grunewald and Bailey, 1993). However little data is available to describe whether or not these postulated effects are of scientific merit. Encouragingly, tests on rodents have yielded increased fertility and spermatogenesis (Ruiz-Luna et al., 2005; Gonzales et al., 2006) and an initial investigation in humans reported a positive effect on physical capacity and immune function (Milasius et al., 2008).

The aim of the current investigation was therefore to investigate the effect of 14 days maca extract (ME) supplementation on 40 km cycling time trial performance and self-reported sexual desire in male cyclists, compared with a placebo.

2. Methods and instrumentation

2.1. Participants

Eight experienced and endurance trained male cyclists were recruited from local amateur cycling and triathlon clubs. Their mean age, height and body mass were 30 ± 7 years, 1.77 ± 0.06 m and 70.2 ± 4.2 kg respectively. Participants were encouraged to undertake their normal training and consume their normal diet throughout the duration of the study, but were asked not to train on the day before each trial. Prior to testing, volunteers

* Corresponding author. Tel.: +44 191 227 4863; fax: +44 191 227 3190.
E-mail address: mark2.stone@unn.ac.uk (M. Stone).

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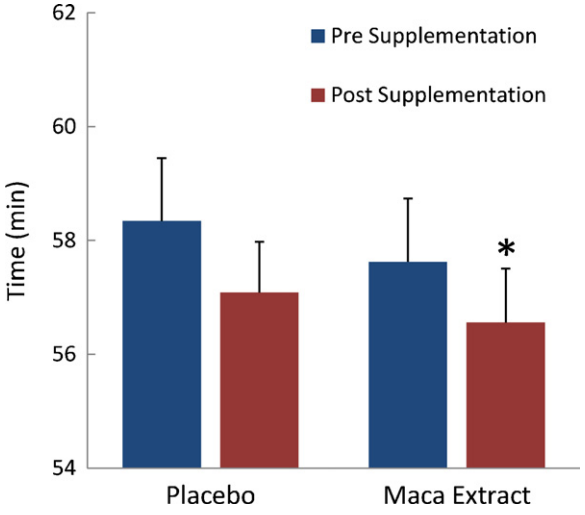


Fig. 1. 40 km time trial performance before and after 14 days supplementation with maca extract and placebo in 8 trained male cyclists. *Significantly different from pre-supplementation ($P = 0.01$).

completed a physical activity readiness questionnaire to ensure that they were fit and healthy. The experiment was conducted in accordance with the code of ethics of the World Medical Association (Declaration of Helsinki) and the testing procedures were approved by Northumbria University Ethics Committee. During recruitment, potential participants were provided with written and oral information about the experimental protocols, including the purpose of the study and any known risks and benefits, and subsequently gave their written consent to participate.

2.2. Maca extract

Maca root voucher no. F15/32/A7, reference no. PW0889 were collected from the Cerro de Pasco region in the central Peruvian Andes Mountains, and deposited at the herbarium of Naturex Inc. The roots were authenticated using macroscopic, microscopic, and high performance thin layer chromatography techniques (Reich and Schibli, 2007). The ME was obtained through an industrial process (batch no. G85/02/D7, Naturex, USA). First, the maca roots were milled, and then the ground roots were soaked in water three times during three hour intervals at 40 °C. After filtration, the clarified solution was concentrated under vacuum at 65 °C. The three pools were combined and concentrated again until the total solids on dry basis were around 60%. This is the native extract, which was then mixed with modified starch and silica as carriers and spry dried to obtain a fine powder. The moisture content in the extract was less than 8%. The extract ratio was approximately 5:1 (Maca root: extract powder).

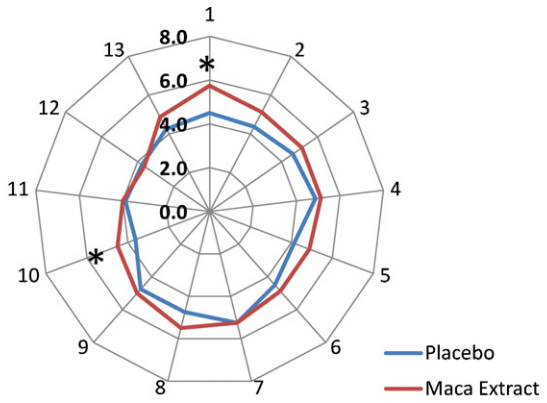
2.3. Treatment

Subjects completed 2 supplementation periods of two weeks during which they were provided with 2000 mg/day (5 capsules each containing 400 mg) of either ME or a placebo (Arabic gum, batch no. E78/49/A7, Naturex, USA). Similar doses have previously been shown to elucidate a beneficial response of ME supplementation on sexual desire and physical performance in men (Gonzales et al., 2002; Milasius et al., 2008). Each supplementation period was separated by at least 1 week washout period. A randomised cross-over design was applied to ensure that the study was fully counter balanced.

2.4. Testing procedures

In order to quantify any changes in endurance exercise performance, each subject completed a self-paced, variable intensity 40 km time trial at the beginning and end of each supplementation period. Previous research has shown that time trial protocols have strong reliability when compared with time to exhaustion protocols, as demonstrated by a typical coefficient of variation of <5% (Currell and Jeukendrup, 2008). Testing was conducted on an electronically braked cycle ergometer (SRM Training System, SRM, Germany) which could be adjusted to replicate the racing position of the subjects (including seat tube, saddle, handlebars and crank length). The cranks were equipped racing pedals allowing subjects to wear their own cycling cleats. Time, heart rate (HR) (Polar Electro, Kemple, Finland) and rating of perceived exertion (RPE) using the Borg modified CR10 scale (Borg, 1982), were recorded at 5 km intervals throughout each trial.

Immediately before each time trial, subjects completed the sexual desire inventory (SDI) (Spector et al., 1996) and returned the forms in a sealed envelope to the investigator. The SDI is a self-administered 14 item questionnaire designed to measure 2 aspects of sexual desire; specifically dyadic (questions 1–9; see Fig. 2) and solitary desire (questions 10–13; see Fig. 2). A high degree of reliability for both subscales ($\alpha = 0.86$ for dyadic desire; $\alpha = 0.96$ for solitary sexual desire) has been reported by its authors (Spector et al., 1996). All items are rated using a Likert-type scale and are summed to calculate an SDI total score.



Q1. During the last month, how often would you have liked to engage in sexual activity with a partner?

Q2. During the last month, how often have you had sexual thoughts involving a partner?

Q3. When you have sexual thoughts, how strong is your desire to engage in sexual behaviour with a partner?

Q4. When you first seen an attractive person, how strong is your sexual desire?

Q5. When you spend time with an attractive person, how strong is your sexual desire?

Q6. When you are in romantic situation, how strong is your sexual desire?

Q7. How strong is your desire to engage in sexual activity with a partner?

Q8. How important is it for you to fulfil your sexual desire through activity with a partner?

Q9. Compared to other people of your age and sex, how would you rate your desire to behave sexually with a partner?

Q10. During the last month, how often would you have liked to behave sexually by yourself?

Q11. How strong in your desire to engage in sexual behaviour by yourself?

Q12. How important is it for you to fulfil your desires to behave sexually by yourself?

Q13. Compared to other people of your age or sex, how would you rate your desire to behave by yourself?

(Spector et al., 1996)

Fig. 2. Sexual desire scores (for individual questions) after 14 days supplementation with maca extract and placebo in 8 trained male cyclists. *Significantly different from placebo ($P < 0.05$).

2.5. Statistical analysis

The data are reported as means ± SD. Paired *t*-tests were used to determine whether there were differences in pre to post supplementation 40 km time and sexual desire in both the placebo and ME trials. Paired *t*-tests were also used to determine differences in post supplementation 40 km time and sexual desire between the placebo and ME trials. Statistical significance was set at $P < 0.05$. All statistical analyses were conducted using the SPSS statistical package for windows version 16.0.

3. Results

There was a significant improvement in time to complete 40 km from baseline to post supplementation in the ME trial (57.62 ± 3.14 min to 56.56 ± 2.68 min; $P = 0.01$) (Fig. 1). All eight subjects completed the time trial in a faster time following 2 weeks supplementation of ME. There was no significant improvement in 40 km time trial time from baseline to post supplementation in the placebo trial (58.34 ± 3.12 min to 57.08 ± 2.53 min $P = 0.16$). There was no significant difference in time to complete 40 km post supplementation between the placebo and ME trials ($P = 0.49$). There were no differences in heart rate or RPE between any of the trials.

Overall sexual desire increased from pre to post supplementation in the ME trial (58.13 ± 16 to 63.63 ± 18.42; $P = 0.01$). Scores for dyadic sexual desire increased from pre to post supplementation in the ME trial ($P = 0.02$) but there was no change in solitary sexual desire ($P = 0.10$). There was no change in sexual desire (total, dyadic or solitary) from pre to post supplementation in the placebo trial (total: 57.38 ± 15.91 to 57.25 ± 17.77; $P = 0.90$ dyadic: $P = 0.68$ solitary: $P = 0.76$). There was no difference in overall sexual desire between groups ($P = 0.66$). Post supplementation overall sexual desire ratings were higher in the ME trial than in the placebo trial ($P = 0.03$). Post supplementation scores for individual questions of the inventory can be seen in Fig. 2.

4. Discussion

Having been consumed by indigenous Peruvians for centuries (Cicero et al., 2001), the rumoured energy enhancing properties of the root of the maca plant have recently gained notoriety (Grunewald and Bailey, 1993), and as such products such as ME have grown in popularity amongst athletes. Previous research exploring the scientific efficacy of maca supplementation on exercise performance has shown that consumption of maca improves various markers associated with sports performance (Milasius et al., 2008); however the trial was not placebo controlled.

In the present study, time to complete a 40 km time trial was significantly improved following 14 days supplementation with ME. All eight cyclists improved their performance time from baseline in the ME trial. Following the placebo supplementation, there was no change in 40 km time trial performance. This study was a randomised cross-over, double blind design therefore any potential learning effects can be ruled out. Given that no changes in either HR or RPE were observed, it is likely that any change in performance was not related to increased effort but rather that other mediating physiological variables were responsible.

Consumption of maca has tentatively been linked with an increase in testosterone in some (Milasius et al., 2008) but not all (Gonzales et al., 2002) studies. Pre-competition elevated hormone levels have been associated with 'the home advantage' and thus increased aggression and performance in team invasion games such as association football (Neave and Wolfson, 2003). It is not known whether such benefits are evident in individual sports, particularly in cycling time trials whereby the athlete competes against the clock rather than direct competition with an opponent.

Elevated testosterone is also assumed to be responsible for increases in markers of sexual desire (Wang et al., 2007). In the present study, 14 days supplementation of ME significantly increased self-rated sexual desire (Spector et al., 1996) with no changes being observed in the placebo trial. These findings support previous *in vivo* investigations into the effect of maca consumption on sexual desire in humans and rats (Cicero et al., 2001; Gonzales et al., 2002). However, Gonzales et al. (2002) did not encounter an increase in sexual desire until 8 weeks of treatment. In this study, participants were subjectively asked to simply report if treatment diminished, did not change, increased mildly or increased moderately to highly sexual desire. In the present study 14 days proved sufficient to elucidate a response in sexual desire, which was analysed using a dichotomous sexual desire inventory with consisting 14 questions targeting both dyadic and solitary sexual desire (Spector et al., 1996). This method is less subjective and thus may be more responsive to change.

5. Conclusion

In summary, 14 days supplementation with ME significantly improved time to complete a 40 km time trial and increased self-reported sexual desire in trained male cyclists. Further *in vivo* experiments are warranted to confirm the efficacy of ME as a tool to improve exercise performance and sexual desire. Future studies should investigate the mechanism of action of ME components on physiological markers during even paced exercise, particularly pre-competition testosterone.

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