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Male Reproductive Nutrition in a Stabilized Black Maca-Oyster Oligopeptide Composite Premix: Human Semen Evidence for Maca and Zinc-Related Context

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Abstract: Male-reproductive nutrition is easier to interpret when the delivered botanical and micronutrient exposures are defined. We characterized a stabilized NVTIA® black maca-oyster oligopeptide premix and compared its composition with human evidence on semen outcomes for maca and zinc-containing interventions. Black maca extract and oyster oligopeptide represented 27.7% and 26.7% of the dry premix, respectively; the formulation also contained L-citrulline, taurine and yeast zinc. After oyster-peptide pre-embedding and post-mixing of black maca, total macamide retention was 88.8% after three months of accelerated storage. A 1 g/day reference intake supplied approximately 277 mg black maca extract, 267 mg oyster oligopeptide and 5 mg elemental zinc. In a 12-week randomized pilot using 1.75 g/day maca, semen measures increased numerically within the maca group but did not differ significantly from placebo. A later randomized trial in 69 men with mild asthenozoospermia and/or oligozoospermia used 2 g/day maca and reported higher sperm concentration than placebo (15.04 ± 5.61 vs 10.16 ± 3.59 ; $P=0.011$), with no significant group differences in semen volume, motility or morphology. Zinc trials also differ by population: combined folate-zinc increased total normal sperm count in an earlier study, whereas a large 2020 infertility-treatment trial found no improvement in semen quality or live birth. The formulation data establish stable macamide and zinc delivery; the human literature indicates that future complete-premix studies should prespecify the male population, baseline nutritional status and individual semen endpoints.

Keywords: male reproductive health; sperm concentration; semen quality; maca; zinc; oyster oligopeptide; macamides

1. Introduction

Semen quality is not represented by one measurement. Concentration, total count, motility, morphology and DNA integrity can change independently, and the clinical meaning of each measure depends on the reproductive setting. Nutritional studies therefore benefit from treating these endpoints separately and documenting baseline fertility and micronutrient status.

Randomized maca studies already illustrate this endpoint specificity. Melnikova et al. tested 1.75 g/day for 12 weeks in healthy men; after exclusions, 18 participants were analyzed, and the

upward within-group semen trends did not produce significant between-group differences [1]. Alcalde and Rabasa later studied 69 men with mild asthenozoospermia and/or mild oligozoospermia. At 2 g/day for 12 weeks, sperm concentration was higher with maca, while volume, motility and morphology were not significantly different from placebo [2]. An earlier open study had reported increases in seminal volume, sperm count and motility and is useful mainly as historical context [3].

Zinc provides a second nutritional axis, but the intervention record is also population-dependent. Wong et al. reported an increase in total normal sperm count after combined folic acid and zinc sulfate in fertile and subfertile men [4]. In a much larger trial involving men from 2370 couples receiving infertility treatment, folic acid plus 30 mg/day elemental zinc for six months did not improve semen quality or live-birth rate [5]. These two trials make baseline status, dose, co-intervention and treatment setting necessary design variables rather than after-the-fact explanations.

2. Materials and Methods

2.1 Composite formulation and marker standardization

The dry premix contained 28 parts black maca extract, 27 parts oyster oligopeptide, 15 parts L-citrulline, 8 parts taurine, 5 parts yeast zinc powder, 9 parts gamma-cyclodextrin, 3 parts gum arabic and 6 parts resistant dextrin. Black maca extract was 5:1 and contained 0.42% total macamides. Oyster oligopeptide contained 72.4% protein, with 78.1% of peptide segments below 1000 Da; the yeast zinc powder contained 10% zinc. Oyster oligopeptide was pre-embedded with gamma-cyclodextrin, gum arabic and part of the resistant dextrin, dried, and then mixed with black maca and the remaining nutritional components before dry granulation.

2.2 Stability, exposure calculation and evidence synthesis

Total macamides were measured by HPLC before and after three months at 40°C/75% relative humidity. Moisture, water activity, sieve distribution and angle of repose were used to describe physical quality. A 1.0 g/day premix intake was used only to calculate formulation-specific exposure for capsules or tablets. Human studies available through 18 August 2026 were identified with maca/Lepidium, semen, sperm concentration, motility, morphology, male fertility, zinc and folic acid search terms. Controlled interventions were prioritized; older open studies were retained only for historical comparison.

Table 1. Composition and Reproductive-Nutrition Context of the Formulation Components

Component	Representative specification	Nominal amount at 1 g/day	Reproductive-nutrition context
Black maca extract	28 parts; 5:1; 0.42% macamides	277 mg	Botanical vitality marker; macamide exposure
Oyster oligopeptide	27 parts; protein 72.4%; <1000 Da peptides 78.1%	267 mg	Small-peptide nutritional matrix
L-citrulline	15 parts	149 mg	Arginine/NO physiological context
Taurine	8 parts	79 mg	Exercise/metabolic context
Yeast zinc powder	5 parts; 10% zinc	49.5 mg powder (~5.0 mg Zn)	Micronutrient contribution
Process matrix	gamma-CD 9; gum arabic 3; resistant dextrin 6	178 mg	Pre-embedding and particle engineering

3. Results

3.1 Composition and formulation stability

Black maca extract accounted for approximately 27.7% of the representative dry blend and oyster oligopeptide for 26.7%. L-citrulline, taurine and yeast zinc powder accounted for 14.9%, 7.9% and 5.0%, respectively. At 1 g premix/day, the corresponding amounts were approximately 277 mg black maca extract, 267 mg oyster oligopeptide, 149 mg L-citrulline, 79 mg taurine and

49.5 mg yeast zinc powder. Because the yeast powder contained 10% zinc, elemental zinc exposure was approximately 5 mg/day.

Initial total macamide concentration was 1.16 ± 0.03 mg/g. After three months of accelerated storage it was 1.03 ± 0.02 mg/g, equivalent to $88.8 \pm 1.5\%$ retention. Comparator retention ranged from 70.5% to 80.0%; the lower values occurred when black maca underwent co-wet embedding or when the entire ingredient blend was wet-granulated. The finished premix contained 3.82% moisture and had a water activity of 0.38.

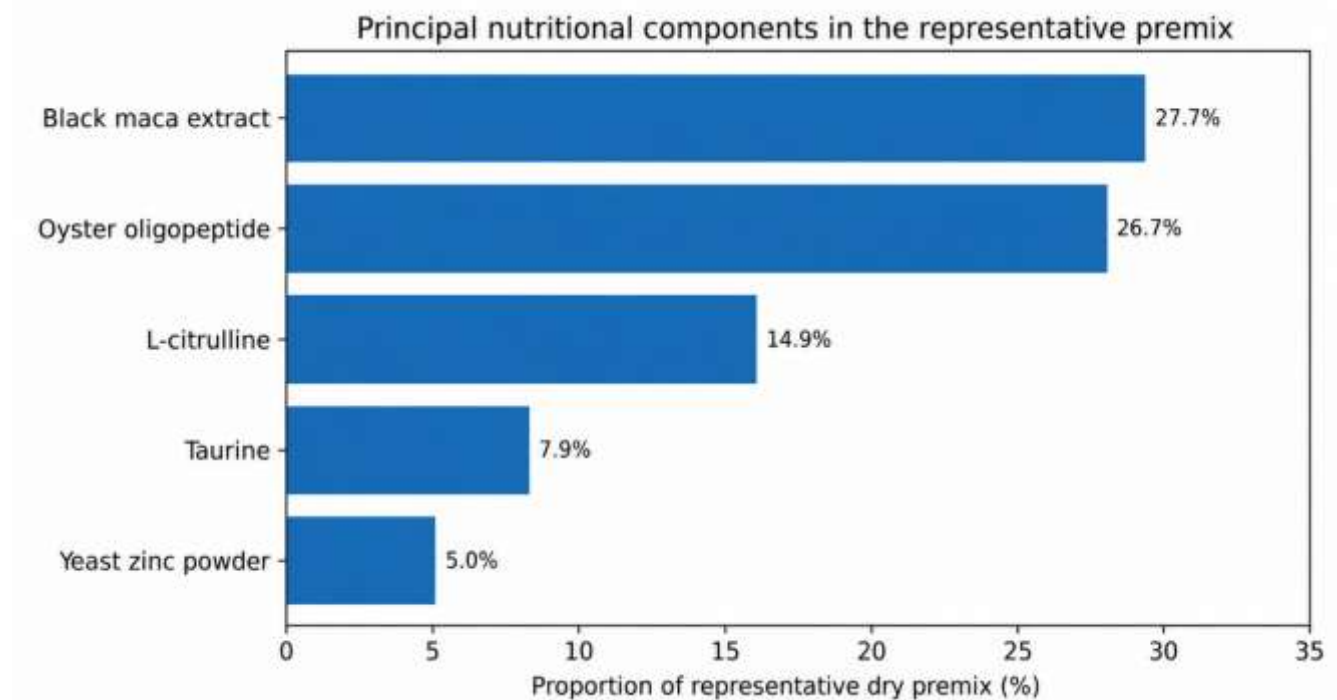


Figure 1. Principal nutritional components as a percentage of the representative dry premix.

3.2 Human semen evidence for maca

Melnikovova et al. administered 1.75 g/day maca for 12 weeks in a double-blind randomized pilot. Eighteen healthy men were included in the final analysis. Total sperm count, sperm concentration, motile sperm count, progressive motility and normal morphology increased numerically within the maca group, but none of the semen parameters showed a statistically significant between-group difference [1]. Reproductive hormone concentrations were broadly unchanged.

Alcalde and Rabasa randomized 69 men with mild asthenozoospermia and/or mild oligozoospermia to maca ($n=35$) or placebo ($n=34$) at 2 g/day for 12 weeks. Sperm concentration was 15.04 ± 5.61 in the maca group and 10.16 ± 3.59 in the placebo group ($P=0.011$). Semen volume was 2.95 ± 0.52 versus 2.90 ± 0.52 , sperm motility 22.34 ± 2.22 versus 23.05 ± 2.22 , and normal morphology 7.89 ± 1.89 versus 7.04 ± 2.28 ; these three endpoints did not differ significantly between groups [2].

3.3 Zinc-related human evidence and hormonal context

The zinc trials separate just as clearly by population. Wong et al. randomized fertile and subfertile men to folic acid, zinc sulfate, their combination or placebo for 26 weeks and reported an increase in total normal sperm count with the combined treatment [4]. Schisterman et al. randomized men from 2370 couples seeking infertility treatment to folic acid plus 30 mg elemental zinc or placebo for six months; semen quality and live-birth outcomes were not significantly improved [5].

Maca-related semen findings should not be assumed to reflect systemic androgen elevation. In healthy adult men, a 12-week randomized study found no meaningful change in serum testosterone, luteinizing hormone, follicle-stimulating hormone or other reproductive hormones after maca [6]. That result favors direct measurement of semen domains and nutritional status rather than using testosterone as a proxy for reproductive response.

Table 2. Summary of Clinical Evidence on Nutritional Interventions and Male Reproductive Outcomes

Study	Population/design	Intervention	Reproductive finding
Melnikovova 2015 [1]	Healthy adult men; randomized double-blind pilot; 18 analyzed	Maca 1.75 g/day; 12 wk	Upward numerical semen trends; no significant between-group semen differences
Alcalde 2020 [2]	69 men with mild astheno/oligozoospermia; randomized double-blind	Maca 2 g/day; 12 wk	Sperm concentration 15.04±5.61 vs 10.16±3.59 (P=0.011); volume/motility/morphology not significantly different
Gonzales 2001 [3]	9 healthy men; open human study	Maca; 4 mo	Reported increases in seminal volume, sperm count and motility; historical signal
Wong 2002 [4]	108 fertile + 103 subfertile men; double-blind randomized	Folic acid, zinc sulfate, combination, or placebo; 26 wk	Combined folate+zinc increased total normal sperm count
Schisterman 2020 [5]	Men in 2370 couples seeking infertility treatment; randomized	Folic acid 5 mg + elemental zinc 30 mg/day; 6 mo	No significant improvement in semen quality or live birth
Gonzales 2003 [6]	Healthy adult men; randomized	Maca 1.5 or 3.0 g/day; 12 wk	No meaningful reproductive-hormone change

4. Discussion

Two formulation variables are already well controlled before a reproductive study begins: macamide exposure and zinc contribution. Total macamides retained 88.8±1.5% of the initial value after accelerated storage, and the reference 1 g/day premix supplies approximately 5 mg elemental zinc. Botanical trials often differ in extract chemistry, and mineral trials are sensitive to baseline status. Holding these formulation variables constant reduces avoidable exposure variation.

The maca evidence does not point to one universal semen response. The 2020 trial separated sperm concentration from motility, morphology and volume [2], while the healthy-volunteer pilot showed numerical changes without between-group significance [1]. Systematic reviews have reached the same practical conclusion: the number and size of human semen trials remain limited, and the effect pattern depends on the semen parameter and study population [7], [8]. A complete-premix trial should therefore prespecify concentration, total count, progressive motility and morphology as separate outcomes.

Zinc has a similar context problem. The folate-zinc trial and the later infertility-treatment trial used different populations and produced different results [4], [5]. A meta-analysis of seminal zinc concentrations also found lower seminal-plasma zinc in infertile men on average, reinforcing the value of measuring baseline zinc status rather than assuming the same starting point for every participant [9]. The approximately 5 mg/day elemental zinc supplied by 1 g of this premix is also well below the 30 mg/day used in the large JAMA trial.

Oyster oligopeptide contributes about 26.7% of the dry mass and contains a high proportion of sub-1000 Da peptides. Direct human semen evidence for this specific peptide preparation is not established in the current source set, so its contribution is best tested inside the standardized complete premix. That design keeps peptide nutrition, maca markers, zinc and amino acids at known simultaneous exposures instead of extrapolating a semen effect from an unrelated peptide product.

5. Current Scope and Future Directions

A prospective study can now be designed around the variables that are already measurable. A defined male population should be enrolled, with at least two baseline semen analyses where feasible. Sperm concentration, total count, progressive motility and morphology can be prespecified independently, and zinc status, dietary intake, smoking, alcohol use and other

fertility-relevant lifestyle factors can be recorded before treatment. Oxidative-stress biology is also a reasonable secondary domain because antioxidant interventions have been studied in male subfertility [10], while dietary-pattern reviews associate overall nutritional quality with semen measures [11], [12]. Oxidative stress and reactive oxygen species are well established mechanistic features of male infertility research [13], [14], and diet-focused reviews likewise emphasize that nutrient and food patterns should be treated as part of the exposure background rather than ignored [15].

6. Conclusion

The stabilized black maca-oyster oligopeptide premix supplies defined maca, peptide and zinc exposures in a low-water-activity matrix. Human maca trials give the clearest direct background for sperm concentration and other semen measures, but responses differ by population and endpoint. Zinc studies show the same dependence on starting status and dose. With macamide retention and micronutrient exposure characterized, the next study can test the complete NVTIA® premix using prespecified semen endpoints and baseline nutritional variables rather than a generalized fertility outcome.

References

- [1] I. Melnikovova, T. Fait, M. Kolarova, E. C. Fernandez, and L. Milella, "Effect of *Lepidium meyenii* Walp. on semen parameters and serum hormone levels in healthy adult men: A double-blind, randomized, placebo-controlled pilot study," *Evid.-Based Complement. Altern. Med.*, vol. 2015, Art. no. 324369, 2015, doi: 10.1155/2015/324369.
- [2] A. M. Alcalde and J. Rabasa, "Does *Lepidium meyenii* (Maca) improve seminal quality?," *Andrologia*, vol. 52, no. 10, Art. no. e13755, 2020, doi: 10.1111/and.13755.
- [3] G. F. Gonzales, A. Cordova, C. Gonzales, A. Chung, K. Vega, and A. Villena, "*Lepidium meyenii* (Maca) improved semen parameters in adult men," *Asian J. Androl.*, vol. 3, no. 4, pp. 301-303, 2001, PMID: 11753476.
- [4] W. Y. Wong, H. M. W. M. Merkus, C. M. G. Thomas, R. Menkveld, G. A. Zielhuis, and R. P. M. Steegers-Theunissen, "Effects of folic acid and zinc sulfate on male factor subfertility: A double-blind, randomized, placebo-controlled trial," *Fertil. Steril.*, vol. 77, no. 3, pp. 491-498, 2002, doi: 10.1016/S0015-0282(01)03229-0.
- [5] E. F. Schisterman et al., "Effect of folic acid and zinc supplementation in men on semen quality and live birth among couples undergoing infertility treatment: A randomized clinical trial," *JAMA*, vol. 323, no. 1, pp. 35-48, 2020, doi: 10.1001/jama.2019.18714.
- [6] G. F. Gonzales, A. Cordova, K. Vega, A. Chung, A. Villena, and C. Gonez, "Effect of *Lepidium meyenii* (Maca), a root with aphrodisiac and fertility-enhancing properties, on serum reproductive hormone levels in adult healthy men," *J. Endocrinol.*, vol. 176, no. 1, pp. 163-168, 2003, doi: 10.1677/joe.0.1760163.
- [7] M. S. Lee, H. W. Lee, S. You, and K.-T. Ha, "The use of maca (*Lepidium meyenii*) to improve semen quality: A systematic review," *Maturitas*, vol. 92, pp. 64-69, 2016, doi: 10.1016/j.maturitas.2016.07.013.
- [8] H. W. Lee, M. S. Lee, F. Qu, J.-W. Lee, and E. Kim, "Maca (*Lepidium meyenii* Walp.) on semen quality parameters: A systematic review and meta-analysis," *Front. Pharmacol.*, vol. 13, Art. no. 934740, 2022, doi: 10.3389/fphar.2022.934740.
- [9] J. Zhao et al., "Zinc levels in seminal plasma and their correlation with male infertility: A systematic review and meta-analysis," *Sci. Rep.*, vol. 6, Art. no. 22386, 2016, doi: 10.1038/srep22386.
- [10] R. M. Smits et al., "Antioxidants for male subfertility," *Cochrane Database Syst. Rev.*, no. 3, Art. no. CD007411, 2019, doi: 10.1002/14651858.CD007411.pub4.
- [11] A. Salas-Huetos, M. Bulló, and J. Salas-Salvadó, "Dietary patterns, foods and nutrients in male fertility parameters and fecundability: A systematic review of observational studies," *Hum. Reprod. Update*, vol. 23, no. 4, pp. 371-389, 2017, doi: 10.1093/humupd/dmx006.
- [12] L.-L. Cao et al., "The effect of healthy dietary patterns on male semen quality: A systematic review and meta-analysis," *Asian J. Androl.*, vol. 24, no. 5, pp. 549-557, 2022, doi: 10.4103/aja202252.

- [13] T. Takeshima et al., "Oxidative stress and male infertility," *Reprod. Med. Biol.*, vol. 20, no. 1, pp. 41-52, 2021, doi: 10.1002/rmb2.12353.
- [14] H. Wagner, J. W. Cheng, and E. Y. Ko, "Role of reactive oxygen species in male infertility: An updated review of literature," *Arab J. Urol.*, vol. 16, no. 1, pp. 35-43, 2018, doi: 10.1016/j.aju.2017.11.001.
- [15] A. Salas-Huetos, E. R. James, K. I. Aston, T. G. Jenkins, and D. T. Carrell, "Diet and sperm quality: Nutrients, foods and dietary patterns," *Reprod. Biol.*, vol. 19, no. 3, pp. 219-224, 2019, doi: 10.1016/j.repbio.2019.07.005.