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**United States Patent**  
**Lignell , et al.****6,410,6**  
**June 25, 20**

Method of increasing the production and improving the quality of semen

**Abstract**

A method of increasing the volume, the total sperm count and the reproductive performance of semen from human and animal males, is described. The method comprises administration of an effective dosage of a human or veterinary preparation containing at least one type of xanthophylls, such as astaxanthin, to said males. Preferably the astaxanthin exists in a form esterified with fatty acids, e.g. in the form of algal meal produced by culturing of the alga *Haematococcus* sp. Further, the use of at least one type of xanthophylls, such as astaxanthin, for the preparation of a human or veterinary preparation for increasing the volume, the total sperm count and the reproductive performance of semen from human and animal males, is disclosed.

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**Claims**

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What is claimed is:

1. A method of increasing the volume, the total sperm count and the reproductive performance of semen from human or animal males, comprising administration of a quality improving dosage of a human or a veterinarian preparation wherein astaxanthin is an active ingredient in said preparation, to said males.
  2. A method according to claim 1, wherein the effective dosage of the preparation contains 0.01 to 1 mg astaxanthin per kg body weight per day.
  3. A method according to claim 1, wherein the astaxanthin is in a form esterified with fatty acids.
  4. A method according to claim 3, wherein the esterified astaxanthin is in the form of algal meal produced by culturing of the alga *Haematococcus* sp.
  5. A method according to claim 3, wherein the effective dosage of the preparation contains 0.01 to 1 mg astaxanthin per kg body weight per day.
  6. A method according to claim 4, wherein the effective dosage of the preparation contains 0.01 to 1 mg astaxanthin per kg body weight per day.
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**Description**

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The human and veterinary preparation of the invention may comprise additional ingredients which are pharmacologically acceptable inactive or active, such as flavoring agents, excipients, diluents, carriers, and the like, and it may be presented in a separate unit dose or in admixture with food or feed. Examples of separate unit doses are tablets, gelatin capsules and predetermined amounts of solutions, e.g., oil solutions, or emulsions, e.g., water-in-oil or oil-in-water emulsions. Examples of food in which the preparation of the invention may be incorporated is dairy products, such as yogurt, chocolate and cereals.

## DESCRIPTION OF EXPERIMENTS

The preparation used in the experiments contained the xanthophyll astaxanthin which was produced via the alga *Haematococcus* sp. by AstaCarotene AB, Gustavsberg, Sweden, and the experimental animal model was boars.

Naturally produced astaxanthin can be obtained also from fungi and crustaceans, in addition to from alga. Astaxanthin from other sources, and other xanthophylls as well, are expected to be similarly useful for the purposes of the invention. An advantage of using astaxanthin from alga is, however, that the astaxanthin exists in a form esterified with fatty acids [Renstrom B. et al, 1981, *Phytochem* 20(11):2561-2564], which esterified astaxanthin thereby is more stable during handling and storage than free astaxanthin.

The experiment was conducted with boars for the purpose of establishing whether astaxanthin supplemented feed increases semen production and improves the reproductive performance even though the breeding sows do not receive such astaxanthin supplemented feed.

## EXPERIMENTAL DESIGN

A total of 37 boars of several breeds used for AI (artificial insemination) were divided into two groups and randomly allocated to one of the two dietary treatments. The boars were fed a standard boar feed either with (3 g/day) or without added NOVASTA.TM. (the trade name of AstaCarothene AB for the algal meal preparation for animals) for 16 weeks. NOVASTA was fed as a top dressing (150 g NOVASTA, containing 1% astaxanthin, mixed with 850 g ground wheat) once daily.

Boars were collected as part of the normal routine of the boar shed. On average boars were collected once per week. Collection was by the gloved hand technique whilst boars were mounted on a dummy sow. Ejaculates were collected into warmed collection container after filtering to remove the gel fraction of the ejaculate. Each ejaculate was weighed to provide an estimate of the volume collected.

During the statistical analysis of the data the age of the boar at the time of collection was included as a covariate.

The semen produced by the boars was then used for mating sows of the commercial herd. There were 1036 matings carried out, 513 matings to NOVASTA supplemented boars and 523 matings to boars from the control group.

## Results of the Experiments

	Semen production	
	Control	NOVASTA
	Period 1 (0-6 weeks)	
Volume (ml)	151.250.sup.a	211.400.sup.b
Sperm density (.times.10.sup.9 /ml)	0.636.sup.a	0.509.sup.b
Total sperm count (.times.10.sup.9)	93.515.sup.a	104.000.sup.a
	Period 2 (7-16 weeks)	
Volume (ml)	150.395.sup.a	178.775.sup.b
Sperm density (.times.10.sup.9 /ml)	0.650.sup.a	0.568.sup.b
Total sperm count (.times.10.sup.9)	95.294.sup.a	96.404.sup.a

.sup.a,b means not sharing superscripts differ significantly (P < 0.05)

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Total sperm count (.times.10. <sup>sup.9</sup> )		93.515. <sup>sup.a</sup>	104.000. <sup>sup.a</sup>
Period 2 (7-16 weeks)			
Volume (ml)		150.395. <sup>sup.a</sup>	178.775. <sup>sup.b</sup>
Sperm density (.times.10. <sup>sup.9</sup> /ml)		0.650. <sup>sup.a</sup>	0.568. <sup>sup.b</sup>
Total sperm count (.times.10. <sup>sup.9</sup> )		95.294. <sup>sup.a</sup>	96.404. <sup>sup.a</sup>

.sup.a,b means not sharing superscripts differ significantly (P < 0.05)

From the above results it is evident that

NOVASTA significantly (P<0.05) increased semen volume and in boars during a 16 week period

Total sperm count increased by on average 6.2 per cent (P>0.05) in boars fed NOVASTA

Feeding NOVASTA to AI boars significantly (P<0.05) increased the number of piglets born alive by 5.4 per cent in sows mated with their semen

The response to NOVASTA in terms of semen volume was much more dramatic in the first 6-weeks of the experiment than in the subsequent 10-week period. The number of sperms produced decreased for both treatment groups during the latter period. However, boars fed NOVASTA produced higher number of sperms in both periods. This was not statistically significant.

The matings resulted in 378 farrowings out of 513 matings of sows mated with boars fed NOVASTA and 359 farrowings out of 523 matings of sows mated with boars of the control group.

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