HUMAN CLINICAL TRIAL SUMMARIES

Krill oil maintains muscle and healthy metabolism during weight loss

Superba Krill® oil delivers superior nutritional support as a multinutrient omega-3 naturally containing high absorption phospholipids, choline and astaxanthin – offering a powerful foundation for weight management support, metabolic health, body composition and muscle health.

SUPERBA*Krill*® AKER BIOMARINE

Obesity as a major global health issue

Obesity is a major global health issue, contributing to chronic conditions such as diabetes and cardiovascular disease. While weight loss through diet can help manage obesity, it often results in muscle loss, which negatively affects strength and metabolism. Similarly, weight-loss medications such as GLP-1 agonists can reduce muscle mass alongside fat.

Krill oil, rich in omega-3 phospholipids with choline, has emerged as a promising nutritional support to preserve muscle during weight loss. A recent study showed that krill oil supplementation during diet-induced weight loss significantly preserved fat-free mass (FFM), handgrip strength, and functional capacity, compared to a placebo.

As a companion product to weight loss efforts, krill oil can provide supportive nutrients that help support metabolic health and maintain muscle mass duing the weight loss process.

Addressing obesity's challenges

Obesity is one of the most pressing global public health challenges of our time, affecting individuals' quality of life and contributing to a wide range of chronic conditions. These include type 2 diabetes, cardiovascular disease, hypertension, compromised bone health, reproductive issues, and even certain cancers [1]. Over the past three decades, the prevalence of obesity has soared, with worldwide adult obesity rates more than doubling since 1990. In 2022, an alarming 2.5 billion adults were classified as overweight, and among them, 890 million were living with obesity [2].

Diet-induced weight loss is an effective solution for addressing overweight and obesity, with studies showing an average loss of 4-5 kg and improvements in cardiovascular risk factors such as blood pressure, cholesterol, and glycemic control [3]. However, about 25-30% of this weight loss comes from fat-free mass (FFM) [4, 5], primarily muscle, which can reduce muscle strength [6-8] and potentially harm metabolic health and immune system regulation due to the critical role of muscle in metabolism [9, 10].

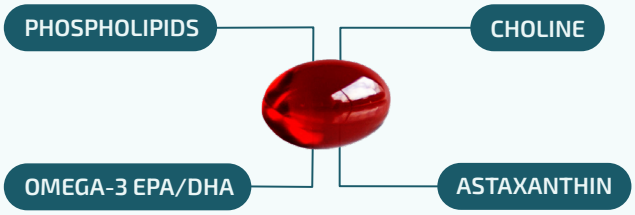
The obesity epidemic has also driven innovation in weight management, including the rise of pharmaceutical weight-loss therapies such as glucagon-like peptide-1 (GLP-1) receptor agonists. Derived from the natural gut hormone GLP-1, these medications have transformed weight loss strategies by targeting appetite regulation and improving metabolic health. However, a notable downside of GLP-1 therapy is the unintended loss of muscle mass alongside fat reduction [11], with muscle loss accounting for 25-39% of total weight lost over 36 to 72 weeks [12].

This rate of muscle decline widely surpasses what is typically seen with natural aging, where 3-5% of muscle mass is lost per decade starting at age 30, accelerating significantly by age 70. But already this muscle loss can lead to adverse health effects, including diminished strength and metabolic dysfunction.This highlights the critical need for targeted strategies to preserve muscle during weight loss intervention.

Supporting muscle health during weight loss with krill oil, a multinutrient omega-3 with choline

Superba Krill®, rich in omega-3 phospholipids, choline, and astaxanthin, may support weight loss by preserving muscle mass and function, reducing inflammation, and protecting against oxidative stress. **Choline** is used to produce acetylcholine, which is needed for muscle contractions [13]. It also supports fat and protein metabolism by reducing fatty acid production and promoting muscle growth. Additionally, choline helps maintain balance in cells, reducing inflammation, cell death, and breakdown. **Omega-3 fatty acids**, particularly EPA and DHA, promote muscle protein synthesis [14-17], improve mitochondrial function [18], and reduce inflammation [19]. These combined benefits make krill oil a promising supplement to support muscle health during fat loss efforts.

The natural combination of key cellular nutrients make krill oil unique



1) Human Clinical Trial Summary: While fasting, krill oil supports fat-free mass and muscle strength

2025 ALBLAJI

Krill oil Supplementation during body weight loss attenuates the decline in fat-free mass and muscle strength.

Published randomized, double-blind, placebo-controlled trial

Location: United Kingdom **Time frame:** 8 wk

Age Range: 29-49 **Total Subjects:** 41

Subjects: Overweight or obese adults (BMI > 25)

Krill Oil Group: n= 21 **Dose:** 4 g/day of Krill oil (772 mg EPA, 384 mg DHA) on alternate days from fasting

Placebo Group n= 20 **Dose:** 4 g/day of mixed vegetable oil on alternate days from fasting

Key Significant Krill Oil Benefits vs Placebo:

- Maintained Fat-free mass I **$p<0.05$**
- Maintained grip strength and results on chair rising test I **$p<0.05$**
- Better improvement on systolic blood pressure and inflammatory markers I **$p<0.05$**

A double-blind, randomized, placebo-controlled trial demonstrated that 4 g/day of krill oil supplementation during diet-induced weight loss via alternate-day fasting significantly preserved fat free mass (FFM), handgrip strength, and functional capacity in healthy adults with overweight and obesity [20].

Specifically, the omega-3 index increased from 5.5% to 8.2% in the krill oil group while in placebo group it went from 5.4% to 5.3%. In addition, the krill oil group maintained fat-free mass (FFM; -0.2 kg), while the placebo group experienced a reduction of 1.2 kg in FFM (Table 1), despite similar total weight loss in both groups (-4.6 kg vs. -4.5 kg).

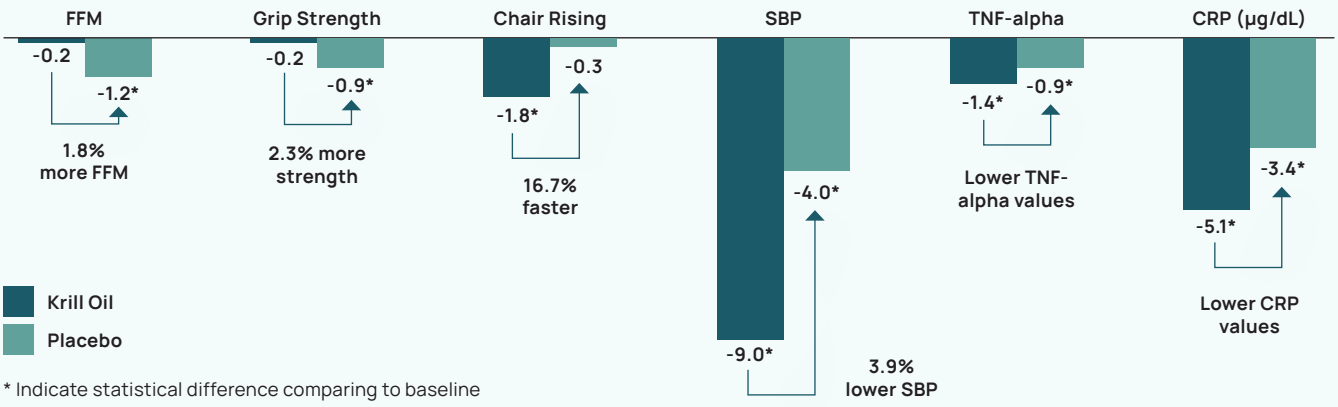
Furthermore, the krill oil group maintained hand grip strength (-0.2 kg) compared to a reduction of 0.9 kg in the placebo group (2.3% improvement favoring krill oil group). The krill oil group also demonstrated a 16.7% faster improvement in the chair rising test and experienced a 3.9% greater reduction in systolic blood pressure relative to placebo. Moreover, plasma inflammatory markers (Tumor necrosis factor alpha and C-reactive protein) were significantly lower in the krill oil group compared to the placebo group.

TABLE 1 | **Participants' FFM, handgrip strength, chair rising test and blood pressure measured pre and post-8-week intervention and changes of these parameters in the Krill oil and Placebo groups**

	Krill Oil Change from baseline	Placebo Change from baseline	P value time* group interaction
FFM (kg)	-0.2±0.9	-1.2±2	$p<0.05$
HGS (kg)	-0.2±0.5	-0.9±0.7	$p<0.05$
CRT (s)	-1.8±0.9	-0.3±1.2	$p<0.05$
Systolic BP (mmHg)	-9±6	-4±4	$p<0.05$
TNF-alpha (pg/ml)	-1.4±0.2	-0.9±0.5	$p<0.05$
CRP (ng/ml)	-51±25	-33.5±12.6	$p<0.05$

*Represents significant difference from baseline within groups *$p<0.05$; ***$p<0.001$ I Time*group interaction: difference between groups

FIGURE 1 | **Participants' FFM, handgrip strength, chair rising test and blood pressure measured pre and post-8-week intervention and changes of these parameters in the Krill oil and Placebo groups**

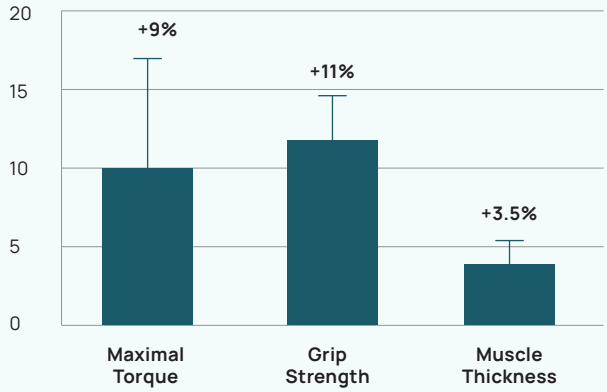


* Indicate statistical difference comparing to baseline

2) Human Clinical Trial Summary: Krill oil supports muscle mass and function

In addition to the benefits with metabolic health, krill oil is also recognized for its benefits to enhance muscle mass and function. For instance, a six-month study [15] involving 94 older adults showed that daily supplementation of 4g/day of SuperbaBoost krill oil led to significant improvements: grip strength increased by 11%, knee extensor strength by 9%, and thigh muscle thickness by 3.5% compared to the placebo group (Figure 2). Additionally, the krill oil group showed a 17% increase in the M-wave, which is linked to muscle strength and neuromuscular function.

FIGURE 2 | **Percent change after 6 months**



2022 ALKHEDHAIRI

The effect of krill oil supplementation on skeletal muscle function and size in older adults: A randomized controlled trial

Published randomized, double-blind, placebo-controlled trial

Location: Scotland **Time frame:** 6 mos

Age Range: 65+ **Total Subjects:** 94

Subjects: Healthy elderly adults

Krill Oil Group: n=49 **Dose:** 4 g/day of Krill oil (772 mg EPA, 384 mg DHA)

Placebo Group n=45 **Dose:** 4 g/day of mixed vegetable oil (<1 mg/g EPA and DHA)

Key Significant Krill Oil Benefits vs Placebo:

- Increased knee extensor maximal torque at 6 mos I **p=.005**
- Increased grip strength at 6 mos I p=.001
- Increased vastus lateralis muscle thickness interaction at 6 mos I **p=.012**
- Increased M-wave amplitude (muscle excitability) I **p<.0001**
- Increased EPA, DHA, AA and omega-3 index I **p<.05**

Krill oil's key benefits for weight loss support

- Helps support a healthy metabolism during weight loss
- Helps preserve muscle mass and strength during weight loss
- Helps maintain fat-free mass while fasting
- Supports healthy inflammation and heart health during weight loss
- Supports muscle function & strength

Conclusion

In conclusion, a decline in muscle mass has not only been associated with weakened strength, but also with reduced immunity, impaired glucose regulation, and other challenges. To ensure weight loss interventions promote overall health, it is essential to prioritize muscle preservation as part of a holistic strategy to dieting, fasting or other interventions like GLP-1s.

An effective approach to weight loss may combine non-pharmacological methods such as calorie restriction or the use of GLP-1 receptor agonists with nutritional support, such as krill oil. This integrated strategy supports fat reduction while maintaining lean body mass, supporting metabolic health, and minimizing potential unwanted negative effects associated with weight loss therapies.

There are over 50+ human clinical trials on Superba Krill® showing benefits for human health:

Wellness/ Immune Support

- Increases the Omega-3 Index
- Improves the omega-6 to omega-3 ratio
- Increases the cell membrane fluidity
- Supports healthy inflammation
- Supports immune function

Backed by 17
Published Human Clinical Trials

Heart Support

- Supports healthy triglycerides levels
- Supports healthy cholesterol
- Helps maintain healthy HDL levels
- Supports cardiovascular health

Backed by 8
Published Human Clinical Trials

Liver Support

- Supports liver function
- Contributes to normal fat metabolism

Backed by 2
Published Human Clinical Trials

Brain Support

- Better activates cognitive function in the elderly compared to fish oil
- Supports memory and brain task management
- Supports brain health

Backed by 1
Published Human Clinical Trial

Healthy Aging Support

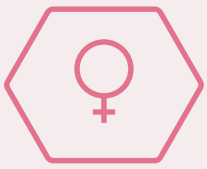
- Supports muscle mass & function against age-related decline
- Improves grip strength
- Helps protect muscle strength & function in older adults

Backed by 1
Published Human Clinical Trial

Dry Eye Support

- Combats challenges of dry eyes such as inflammation, irritation & redness

Backed by 1
Published Human Clinical Trials



PMS Support

- Supports the emotional & physical challenges related to premenstrual syndrome

Backed by 1
Published Human Clinical Trial

Skin Support

- Supports skin hydration & elasticity
- Supports skin moisture for smoother, softer skin

Backed by 5
Published & Proprietary Human Clinical Trials

Joint Support

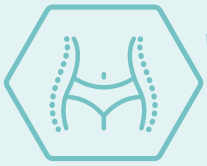
- Supports knee comfort
- Improves flexibility & mobility
- Improves physical function

Backed by 3
Published Human Clinical Trials

Sports Performance Support

- Supports muscle function & strength
- Promotes healthy recovery rate after workout
- Prepares your body for optimal sports performance

Backed by 6
Published Human Clinical Trials



Weight Loss Support & Strength

- Helps support a healthy metabolism during weight loss
- Helps preserve muscle mass and strength during weight loss
- Supports muscle function & strength

Backed by 2
Published Human Clinical Trial

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SUPERBA*Krill*®

AKER BIOMARINE

Aker BioMarine ASA
Oksenøyveien 10, P.O Box 496, NO-1327
Lysaker, Norway
47-24-13-00-00
E-mail: info.us@akerbiomarine.com

www.superbakrill.com
www.akerbiomarine.com
www.krealkrill.com
www.nko-krill.com