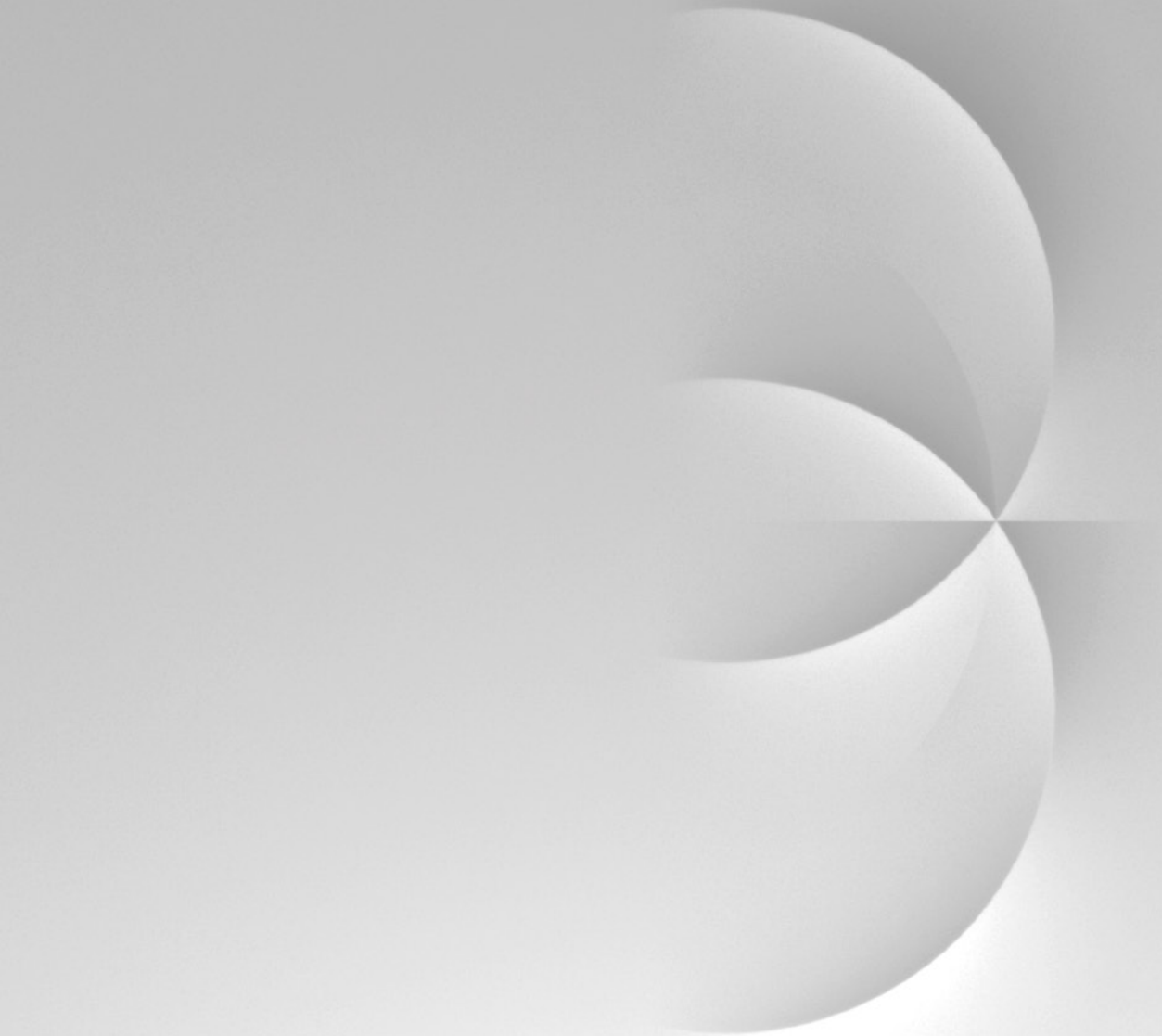
whitepaper

Salmigo® Protect L60 and its potential to replace Glycerine in semi-moist pet treats

may 2022



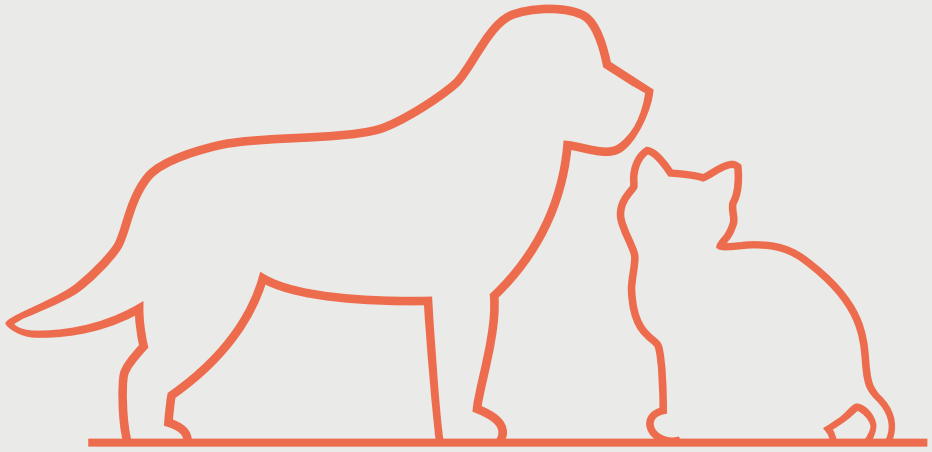
biomega®

value vitality

The rise in popularity of semi-moist pet foods and treats

The global pet food market continues to grow year-on-year. According to the American Pet Products Association (APPA), petfood sales have increased by at least 3.7% to as much as 10.7% since 2007[1]. By the end of 2021, research firm Packaged Facts reported that cat and dog food sales hit $37.1 billion, representing a 6.4% increase compared to 2020[2]. By 2025, the pet food market is projected to reach 47.9 billion at a CAGR of 6.6%[3]. In Europe, the picture is also similar with The European Pet Food Industry stating that sales of petfood products in 2020 saw €21.8 billion in turnover, with a 2.8% average annual growth rate recorded[4].

With the growth in petfood, snacks are also on the rise. Research from Mintel stated that sales of pet treats had begun to outpace both dog and cat food between 2012 and 2017, increasing by 29% during the period to reach $4.39 billion[5]. Since then, Global Market Insights have estimated that the global dog food and snacks combined market could surpass $75 billion by 2025[6], while global cat food and snacks are currently on track to reach $44.89 billion in 2027[7]. →



[1]*American Pet Products Association*, 2019, referenced in Petfood Processing, 'State of the US petfood and treat industry 2019', Dec 2019 https://www.petfoodprocessing.net/articles/13528-state-of-the-us-pet-food-and-treat-industry-2019

[2]*Packaged Facts, 2021,* referenced in Petfood Processing, 'Pet food market update from Packaged Facts,' November 2021 https://www.petfoodprocessing.net/articles/15279-pet-food-market-update-from-packaged-facts.

[3]The European Pet Food Industry, 'European Facts & Figures 2019', 2020. Accessed via: http://www.fediaf.org/52-dcs-statistics

[4]The European Pet Food Industry, 'New FEDIAF data confirms European pet ownership strong with 88 million households benefiting from pet ownership', 2021. Accessed via: https://www.fediaf.org/press-releases/2782-facts-and-figs-2020.html

[5]Mintel, *'US Pet Food Market Report',* 2017. https://www.mintel.com/press-centre/social-and-lifestyle/us-sales-of-pet-treats-outpace-dogcat-food-over-the-last-five-years

[6]Global Market Insights, Inc, *'Dog Food and Snacks to surpass $75 billion by 2025',* March 2019, https://www.globenewswire.com/news-release/2019/03/25/1760011/0/en/Dog-Food-and-Snacks-Market-to-surpass-75-billion-by-2025-Global-Market-Insights-Inc.html

[7]Global Market Insights, Inc, *'Cat food and snacks market size',* 2020, https://www.gminsights.com/industry-analysis/cat-food-and-snacks-market

For consumers, petfood and treats that offer convenience over cost are in demand. While dry kibble continues to dominate the US petfood market with 72% of sales[8], there is a considerable focus on pet wellness across the globe, with owners more willing to try a broader range of products than they were a decade ago. For instance, traditionally there have been nutritional drawbacks to feeding pets a semi-moist diet. Yet many of the semi-moist foods today are now much healthier than they were, primarily due to pet owners calling for fewer additives deemed unhealthy and more nutritionally driven ingredients.

Of course, when it comes to semi-moist foods, there are still pros and cons. For dogs, especially, semi-moist foods are highly palatable and are easy and convenient to serve. Snacks or treats are also excellent for training as they can be broken into smaller pieces, so there is no worry or fear of over-feeding. Unfortunately for owners, semi-moist foods tend to be much more expensive and can contain artificial colours, preservatives or flavour enhancers.

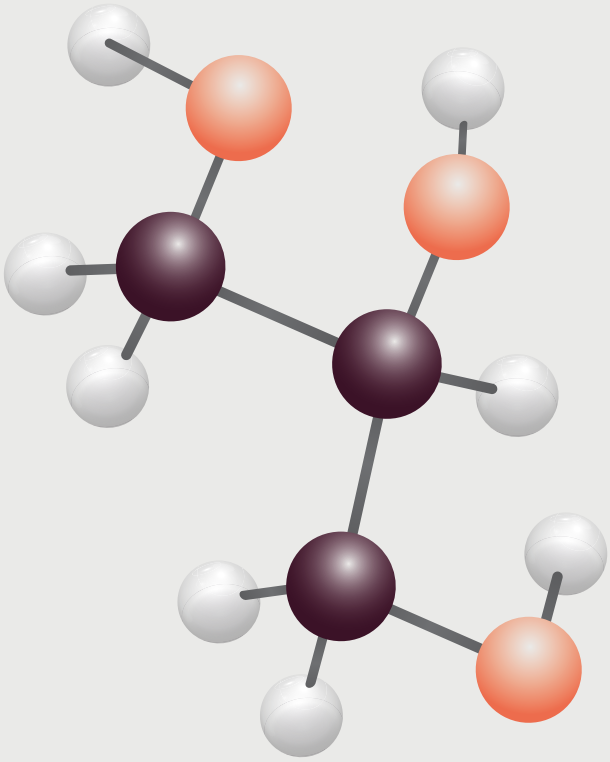
Chemical humectants, such as glycerine, is one of the ingredients that is often identified as a strict no-go for pet owners. Recent studies have questioned whether the addition of glycerine in complete, semi-moist food can overwhelm the catabolic capacity in puppies and cats[9]. Most semi-moist snacks use vegetable glycerine derived from plant sources, but the nutritional value of these is defunct, leading to owners searching for more natural alternatives.

[8]Packaged Facts, 2019, referenced in Petfood Processing, *'State of the US petfood and treat industry 2019'*, Dec 2019 https://www.petfoodprocessing.net/articles/13528-state-of-the-us-pet-food-and-treat-industry-2019

[9]Beynen AC, *'Glycerine in semi-moist petfoods'*, 2019 https://www.researchgate.net/publication/331310917_Beynen_AC_2019_Glycerine_in_semi-moist_petfoods

What is glycerine?

Glycerine or glycerol has three carbon atoms and in animals, and humans, is a common building block of glycolipids, triglycerides and phospholipids. It is usually added to pet food applications as a way of binding water in canned foods and treats by lowering water activity, alongside acting as a preservative and sweetener. Known as a humectant, it gives pet meals the necessary elasticity to deliver a chewy texture and offers additional palatability for dogs too. As such, semi-moist pet foods usually contain 11-20% water, with glycerine ranging from 10-15%.



According to the U.S. Food and Drug Administration, glycerine is generally recognised as safe (GRAS) for use in pet and human food, but this does not extend to crude glycerine developed from biodiesel production. The type of glycerine that is commonly used in pet food is vegetable glycerine, which is a food-sourced product, and is used in all types of pet applications, including food, treats and even shampoo as a great way to moisturise and condition dog fur. Cats, for instance, are able to metabolise glycerine and use it as an energy source without compromising their health[10]. However, while vegetable glycerine is safe, it is considered by pet owners as an unhealthy ingredient due to its contribution to a higher energy content.

Biomega Group, a Norwegian biotechnology company producing high-quality ingredients for the premium pet food sector, has in a recent study verified that its liquid protein product, Salmigo® Protect L60 – alongside its nutritional properties and great palatability – can be used as a substitute to glycerine, delivering a viable alternative for the semi-moist petfood market.

[10]Machado GS, Pezzali JG, Marx FR, Kessler AM, Trevizan L. *Palatability, digestibility, and metabolizable energy of dietary glycerine in adult cats.* J Anim Sci. 2017;95@:752-760. doi:10.2527/jas.2016.0851

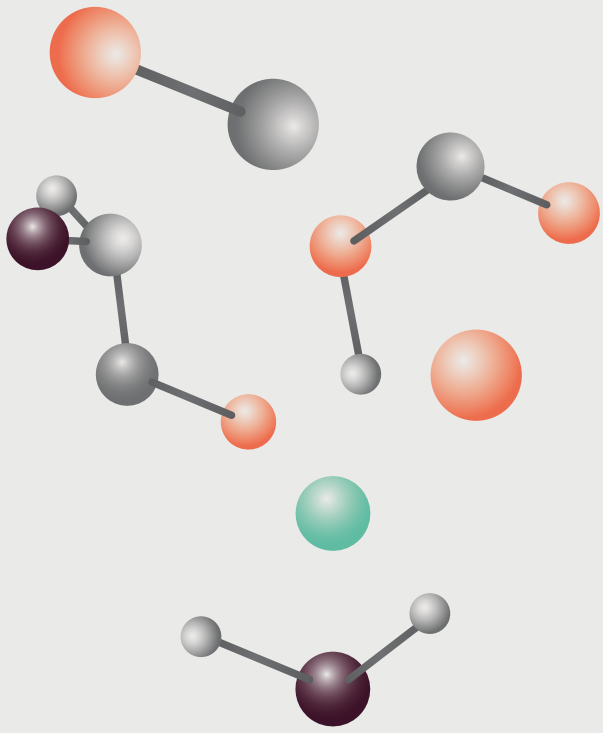
Introducing Salmigo® Protect L60 – a highly nutritional salmon peptide with great palatability

As a producer of sustainable, natural salmon-based ingredients, biomega® has invested in new research and technology that may deliver beneficial advantages to the pet food and snack market. By using bioactive salmon peptides, the purpose of a recent study was to investigate and analyse the potential functional properties of concentrated salmon peptides and discover the impact on the quality of pet food.

To do this, biomega® extract the protein of the salmon species through various methods in industrial scale production. By utilising a proprietary continuous non-GMO food grade enzyme extraction process and using fresh salmon raw material, biomega® gently hydrolyses the proteins to convert them into bioactive salmon peptides. In doing so, this preserves the highly functional and nutritional value, resulting in bioactive salmon peptides such as Salmigo® Protect L60.

This salmon peptide contains partially digested protein in a liquid format. When pets, such as dogs and cats, consume these salmon peptides it allows the amino acids to be absorbed much faster than intact native proteins, thus having the potential to maximise nutrient delivery to body tissues. Its distinct salmon taste and smell make it especially palatable to dogs and cats in pet food applications.

Compared with glycerine, Salmigo® Protect L60 contributes to increased protein content, as well as taurine and niacin – both essential nutrients for cats[11]. In theory, and as carnivores, cats should show higher appreciation of Salmigo® Protect L60 than to glycerine. Therefore, discovering the ingredient that can improve the acceptability of semi-moist cat treats may open additional opportunities in the pet food and snack market.



[11]MacDonald ML, Rogers QR, Morris JG. *Nutrition of the domestic cat, a mammalian carnivore.* 1984 Ann Rev Nutr 4: 521-62. Doi:10.1146/ANNUREV.NU.04.070184.002513

Replacing glycerine with biomega® Salmigo® Protect L60 – the scientific evidence

A recent study carried out on behalf of biomega® by Passion4Feed AS evaluated the replacement of glycerine with Salmigo® Protect L60. The research assessed the ingredient's impact on the texture, appearance and sensory properties in semi-moist pet treats, alongside the shelf life stability of the product following the removal of glycerine.

Materials & Methods

In total, six formulations were prepared and tested, with three semi-moist snack formulations for dogs and cats produced. Tables 1 and 2 show the percentage of each ingredient used. Table 3 shows the proximate composition of the formulations. It's useful to note that the formulation used for cats can also be used as a high protein dog snack formulation.

Table 1
Formulation of the semi moist snacks for dogs, %

Description, %	Dog 1	Dog 2	Dog 3
Salmigo® Active	18.5	18.5	18.5
Salmigo® Protect L60	0	15	20
Rice flour	19.5	19.5	19.5
Cold swelling-pea starch-flour	37.95	37.95	32.95
Glycerine	15	0	0
Pea fibre	5	5	5
Antioxidant	0.05	0.05	0.05
Preservative mix	4	4	4
	100	100	100

Table 2
Formulation of the semi moist snacks for cats, %

Description, %	Cat 1	Cat 2	Cat 3
Salmigo® Active	26.95	26.95	26.95
Salmigo® Protect L60	0	15	20
Rice flour	18	18	18
Cold swelling-pea starch-flour	33	33	28
Glycerine	15	0	0
Pea fibre	3	3	3
Antioxidant	0.05	0.05	0.05
Natural flavour	1	1	1
Preservative mix	3	3	3
	100	100	100

Table 3
Proximate analyses of the mixture

	DOG			CAT		
	Dog 1	Dog 2	Dog 3	Cat 1	Cat 2	Cat 3
Moisture, %	8.4	12.3	14	8.9	12.8	14.5
Crude Protein, %	19	26.5	28.3	24	31.4	33.2
Crude Fat, %	3.1	3.3	3.3	4.2	4.4	4.4
Crude Fibre, %	4.5	4.5	4.4	3	3	2.9
Ash, %	3	3.7	3.9	3.4	4	4.3
Added Glycerine, %	15	0	0	15	0	0
Rest carbohydrates (NFE), %	47	49.7	46.1	41.5	44.4	40.7

Both 'Dog 1' and 'Cat 1' formulations were made with 15% of glycerine. In the diets for 'Dog 2' and 'Cat 2', 15% glycerine was replaced with Salmigo® Protect L60. With 'Dog 3' and 'Cat 3', the Salmigo® Protect L60 level was increased to 20%, thus content of the starch product (Cold swelling pea starch-flour) was reduced while protein level was increased.

Image 1
Prepared meals for cat diets

Supplied in meal form *(Image 1)*, the ingredients were weighed and mixed to create 9 kg of dog and cat meals in total.

We explored the production of two types of snacks. The first were short dog sticks *(Image 2)* and long cat sticks *(Image 3)* – with Salmigo® Protect L60 added to the mixture at 0%, 15% or 20%. The snack with 0% Salmigo® Protect L60 was substituted with 15% glycerine to obtain a valid comparison. The second *(see Image 4 and 5)* short snacks were produced with the same percentage of Salmigo® Protect L60 applied in each case.

Image 2
Dog snacks at 0%, 15% and 20% Salmigo® Protect L60 inclusion

0% 15% 20%

Image 3
Cat snacks at 0%, 15% and 20% Salmigo® Protect L60 inclusion

0% 15% 20%

Image 4
Round and short dog snacks

0% 15% 20%

Image 5
Octagonal and short cat snacks

0% 15% 20%

Table 4
Tests were initiated on each of the snacks to test six areas

Area	Testing Method
Texture	Using the Perten Instrument texture analyser, we tested 15-18 kibbles at 100kg each, with a cutting probe to imitate bite motion
pH Level	Using Mettler Toledo F2 pH meter; 50g of each sample submerged in 100g of tap water for 30 minutes, repeated twice for accuracy
Water Activity (aW)	Rotronic HP23-AW used to analyse water, repeated twice for accuracy
Moisture Content	Halogen moisture analyser, Sartorius MA 35 – 130°C for 10 minutes
Palatability	First choice test x speed of consumption (e.g. 10 x dogs for 3 days, 10 x cats for 3 days)
Appearance	Unlabelled samples - colour, shape and texture appearance tested by dog and cat owners

Test Results

Production feasibility

From a production perspective it was noted that to replace glycerine with Salmigo® Protect L60, the single screw extruder required additional water to operate efficiently. Twin screws would therefore be recommended to create longer products due to the higher sheer and kneading requirements. In addition, Salmigo® Protect L60 should be heated to 40°C to reduce viscosity, making it easier to add during the process.

Cat kibbles caused potential issues and additional Salmigo® Protect L60 increased feed throughput, along with knives being adjusted for preferable size. It was also noted that the Control kibbles *(Dog 1 and Cat 1)* were shorter compared to the Salmigo® Protect L60 tests.

Appearance

In terms of appearance, dental sticks for dogs could not be achieved with glycerine due to ruptures, they were also paler and drier. However, Salmigo® Protect L60 was able to bind on lower temperatures to form non-sticky ropes. Though higher starch content resulted in a paler appearance, Salmigo® Protect L60 darkened the treats for a meatier look – as seen with cat snacks in *Image 3* and *5*. Finally, Kibbles with Salmigo® Protect L60 were chosen by pet owners, as they preferred the natural appearance of the colour, texture and uniformity of the treats.

Expansion

The dog kibbles with 15% Salmigo® Protect L60 significantly improved expansion due to high starch and water content *(see Figure 1)* and cat kibbles in the second production run decreased expansion due to reduced water content. However, they still showed a slight expansion effect *(see Figure 2)*.

Texture

Dog kibbles decreased in density with Salmigo® Protect L60, making it easier to break or cut *(see Figure 3)*. Cat kibbles with Salmigo® Protect L60 increased density slightly at 15%, however at 20% Salmigo® Protect L60 inclusion density decreased again. For cats, the 15% density level is preferential as when a cat consumes a kibble, the firmness should be similar to a small mouse, thus engaging their natural instincts.It's possible that different processing methods will cause alternative results *(see Figure 4)*.

Palatability

There was a clear acceptance by dogs, although 'Dog 2' was the first choice in palatability with 100% acceptance, alongside a sharper rise in pieces consumed at a faster rate – (*see Figure 5)*. Cats, in general, were less likely to accept the snacks (10% or less acceptance) with 15% glycerine in 'Cat 1'. Depending on the choices presented, cats were most likely to choose and consume the treat with the most Salmigo® Protect L60 at a faster rate. So, when presented with 15% Salmigo® Protect L60 (*Cat 2*) and 20% Salmigo® Protect L60 (*Cat 3*), 'Cat 3' was the clear winner with 70% acceptance and a fast consumption rate – (*see Figure 6 and 7)*.

Preservation and shelf life

Notably, there was an increase in water activity for kibbles with 15% and 20% Salmigo® Protect L60 *(see Figures 8 and 9)* but despite this, kibbles were stable with no mould or other bacterial growth. Only minor changes were seen in pH of the different kibbles *(see Figure 10 and 11)*. Clearly when this formulation is moved to a commercial application, this would result in improved control over processing methodology. A recommended preservation mix for commercialisation is shown in Tables 5 & 6.

Table 5

Preservation mix for kibble production

Preservative mix	Dog	Cat
Citric acid, %	2.35	1.5
Sodium chloride, %	1	1
Potassium sorbate, %	0.5	1
MycoCurb (mix prop acid), %	0.1	0.2
Antioxidant, %	0.05	0.05

Table 6

Recommended preservation mix for commercialisation

Preservative mix	Dog and Cat
Citric acid*, % / Lactic acid	In total up to 2.5
Sodium chloride, %	From 1 – 2
Potassium sorbate, %	0.5 – 1
Calcium propionate, %	0.1 – 0.2
Antioxidant, %	0.05 – 0.1

*Citric acid can be effectively combined with the lactic acid or high purity phosphoric acid.

Graphical Illustrations of Results

Figure 1
Expansion level for semi-moist dog kibbles (low to medium protein)

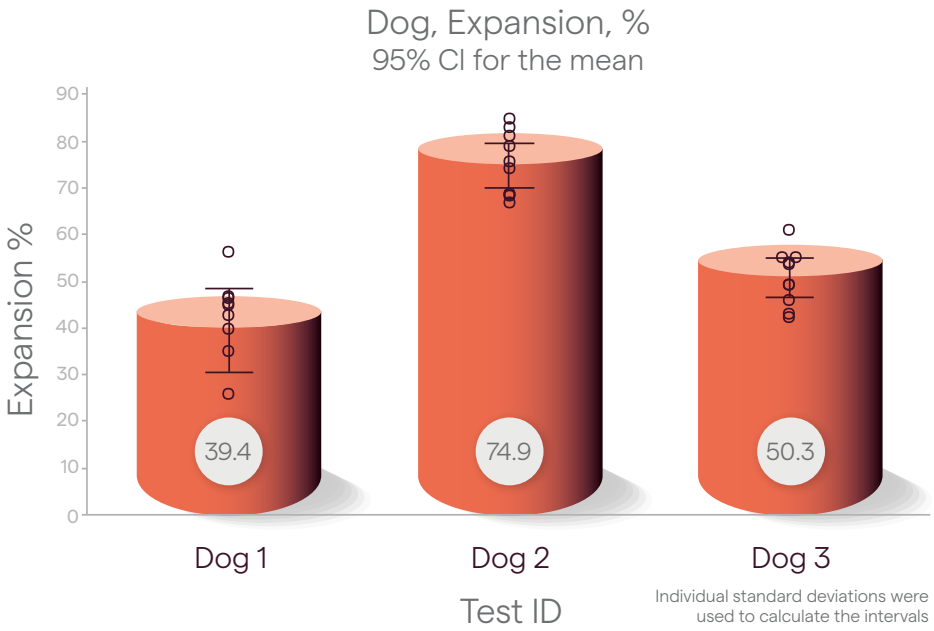


Figure 2
Expansion level for semi-moist cat kibbles (high protein)

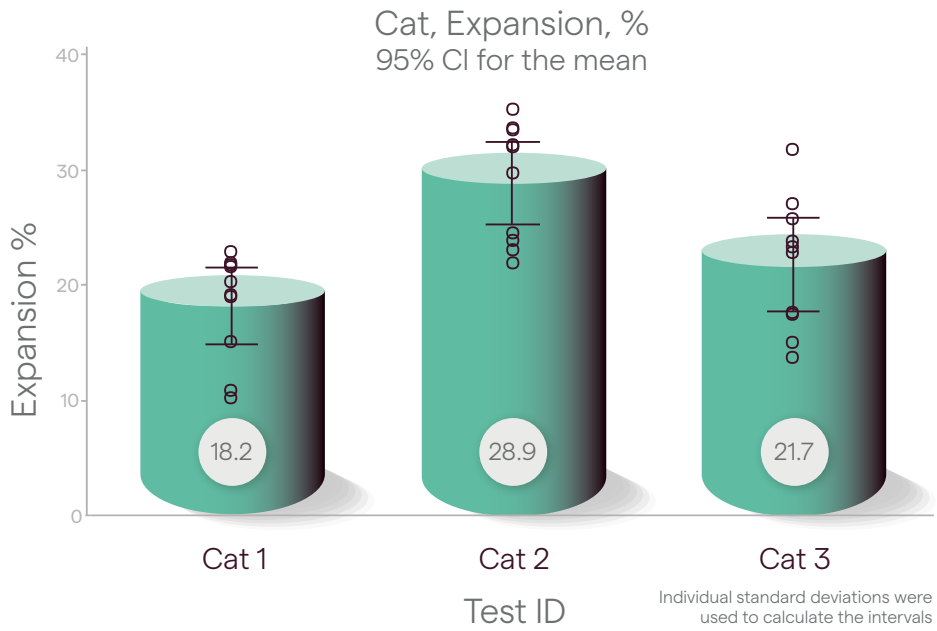


Figure 3
Dog kibbles density / firmness results presented in grams

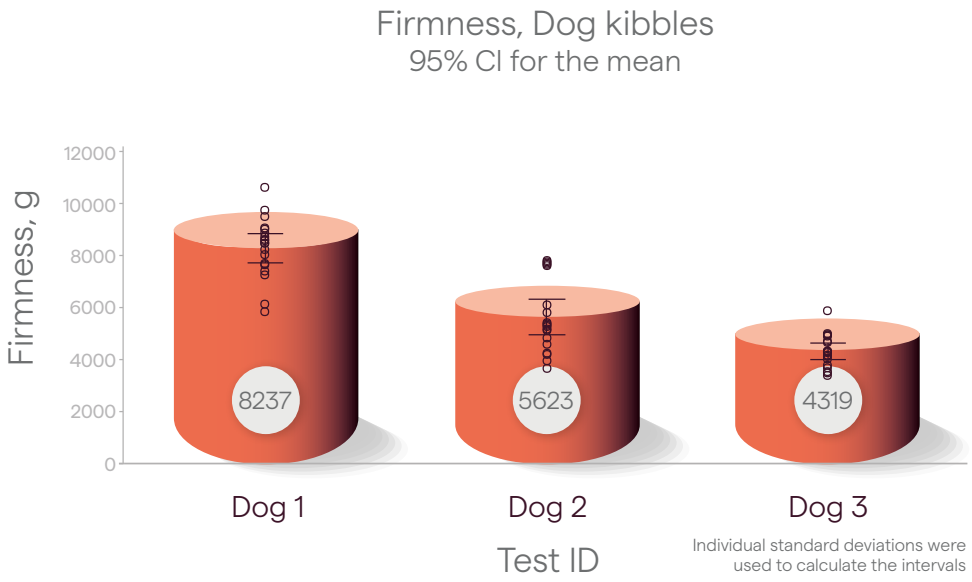


Figure 4
Cat kibbles density / firmness presented in grams

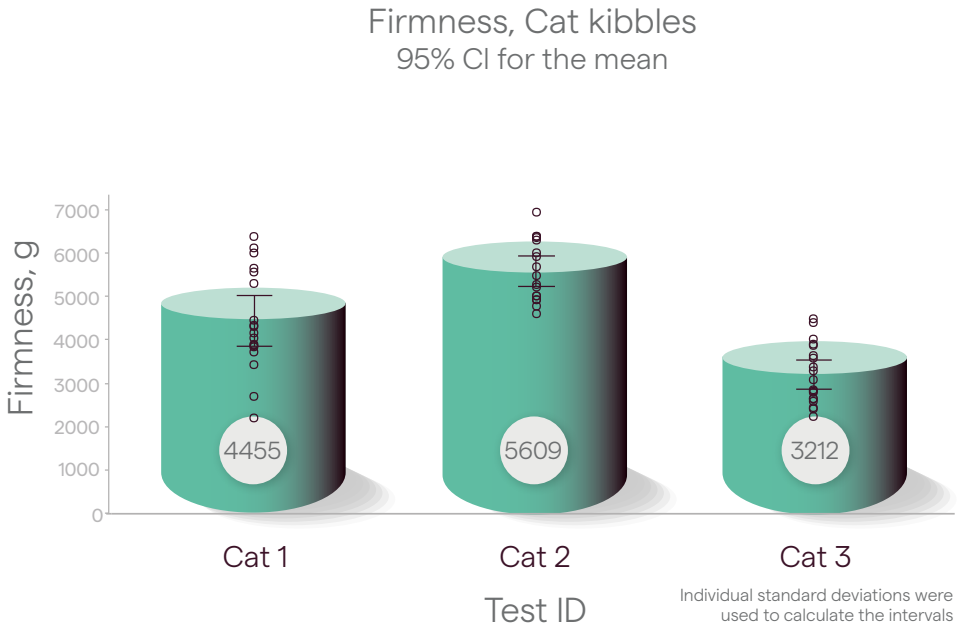


Figure 5

First choice test for dogs – speed of consumption x snack pieces consumed

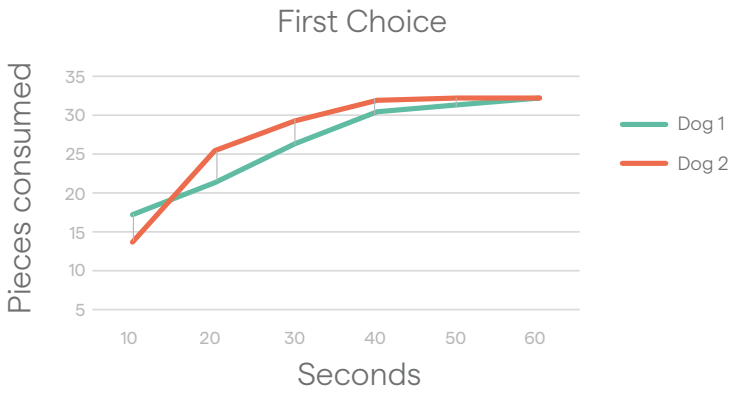


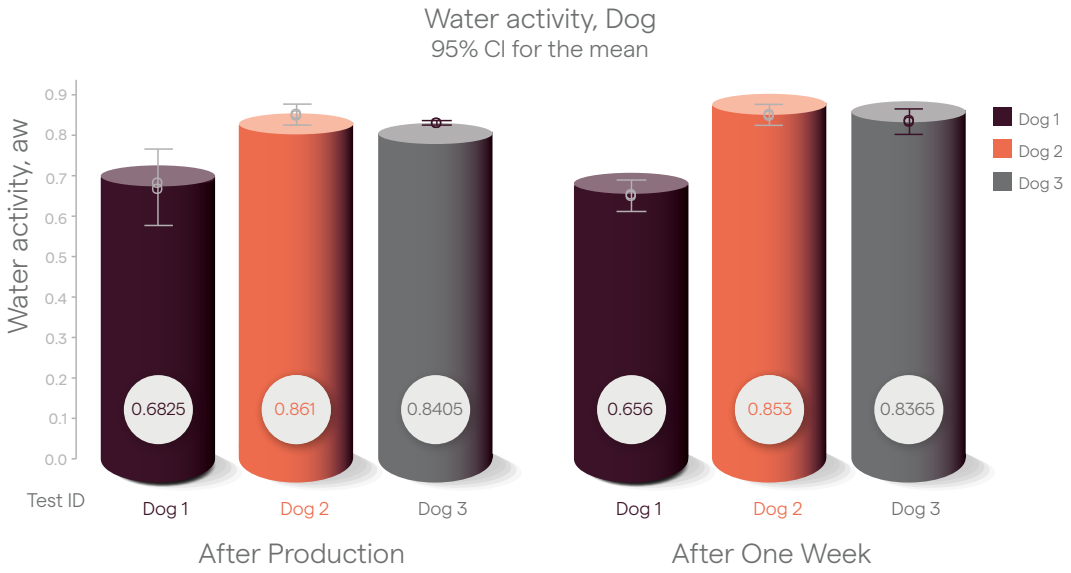
Figure 6

First choice test for cats – speed of consumption x snack pieces consumed

Figure 7

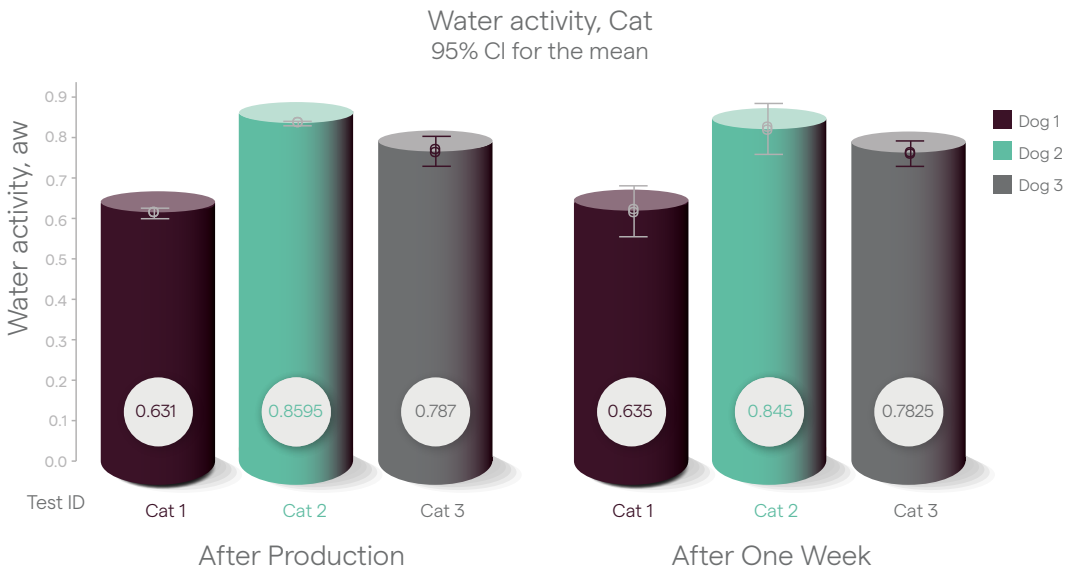
First choice test for cats – speed of consumption x snack pieces consumed

Figure 8
Water activity in dog kibbles



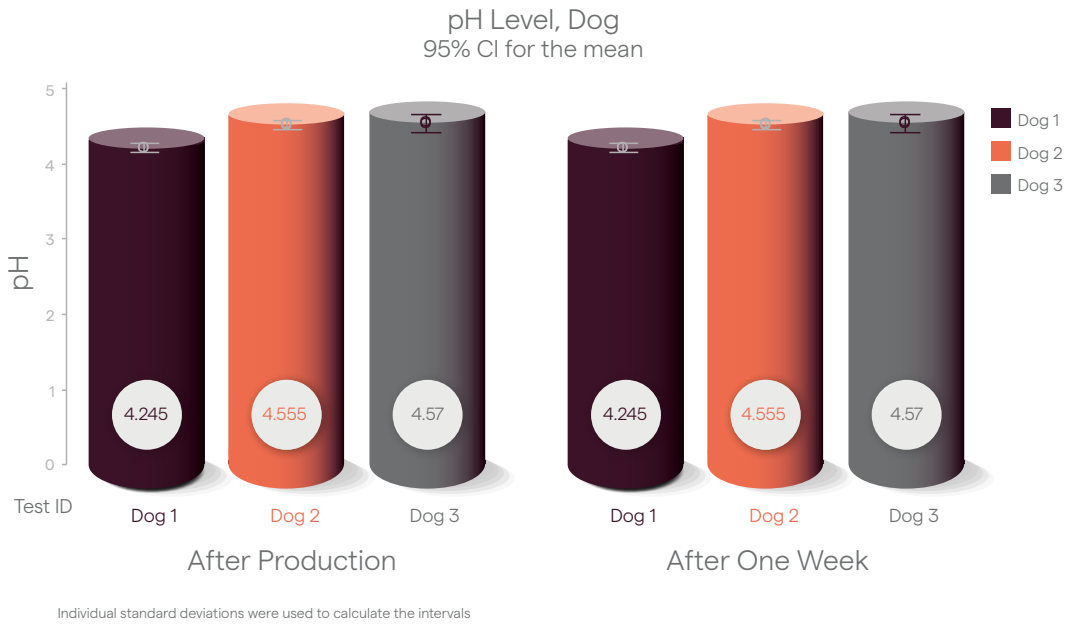
Individual standard deviations were used to calculate the intervals

Figure 9
Water activity in cat kibbles



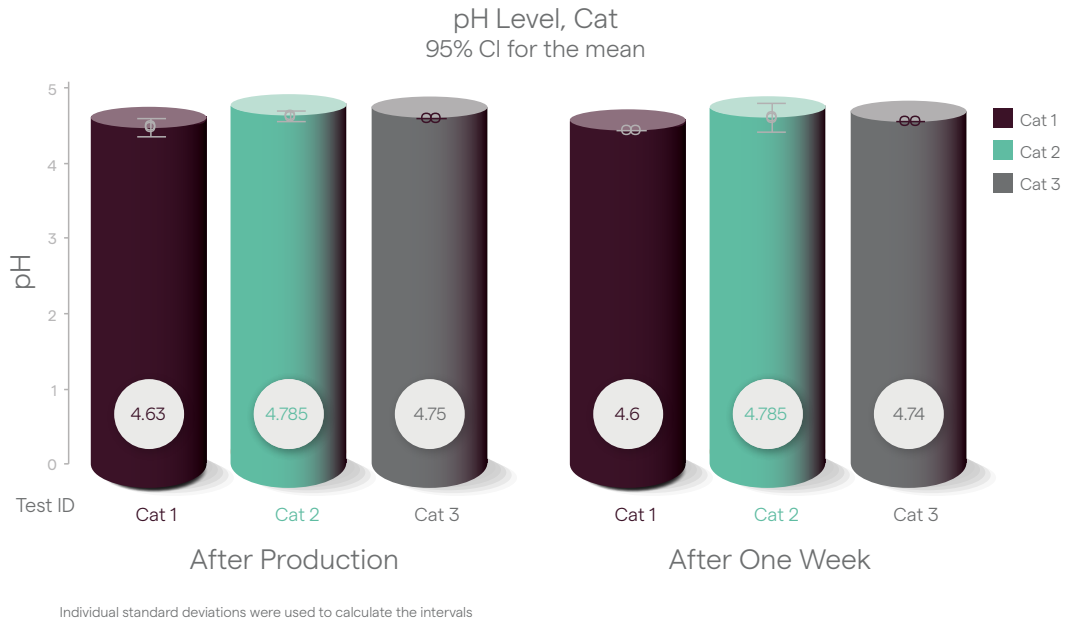
Individual standard deviations were used to calculate the intervals

Figure 10
pH level in dog kibbles



Individual standard deviations were used to calculate the intervals

Figure 11
pH level in cat kibbles



Individual standard deviations were used to calculate the intervals

In summary

With the advancements in technology processes, combined with the highly nutritional value of Salmigo® Protect L60 from biomega®, which results in a direct increase in protein alongside a decrease in energy content, it is possible to remove glycerine from semi-moist pet treats. As such, the results found that Salmigo® Protect L60:

- **Contributes with a highly digestible diet protein**
- **Positively impacts the appearance of kibbles with a darker, natural and meaty look**
- **Enables the production of long stick snacks – especially for cats**
- **Improves expansion and increases size of kibbles**
- **Improves throughput during production**
- **Enhances the shape and texturisation of kibbles**
- **Significantly improves palatability for cats compared to glycerine by 20% - 70%, resulting in first choice every time**
- **Offers slight improvement in palatability for dogs compared to glycerine due to increase in speed of consumption**
- **Increases moisture content compared to glycerine, meaning careful attention must be paid to the formulation mixture in relation to water content**

As part of the company's ethos to value vitality, value today and value tomorrow, biomega® will continue to invest in research that supports animal wellness through the inclusion of bioactive salmon peptides in petfood treats and other applications.

References:

[1] American Pet Products Association, 2019, referenced in Petfood Processing, *'State of the US petfood and treat industry 2019'*, Dec 2019 https://www.petfoodprocessing.net/articles/13528-state-of-the-us-pet-food-and-treat-industry-2019

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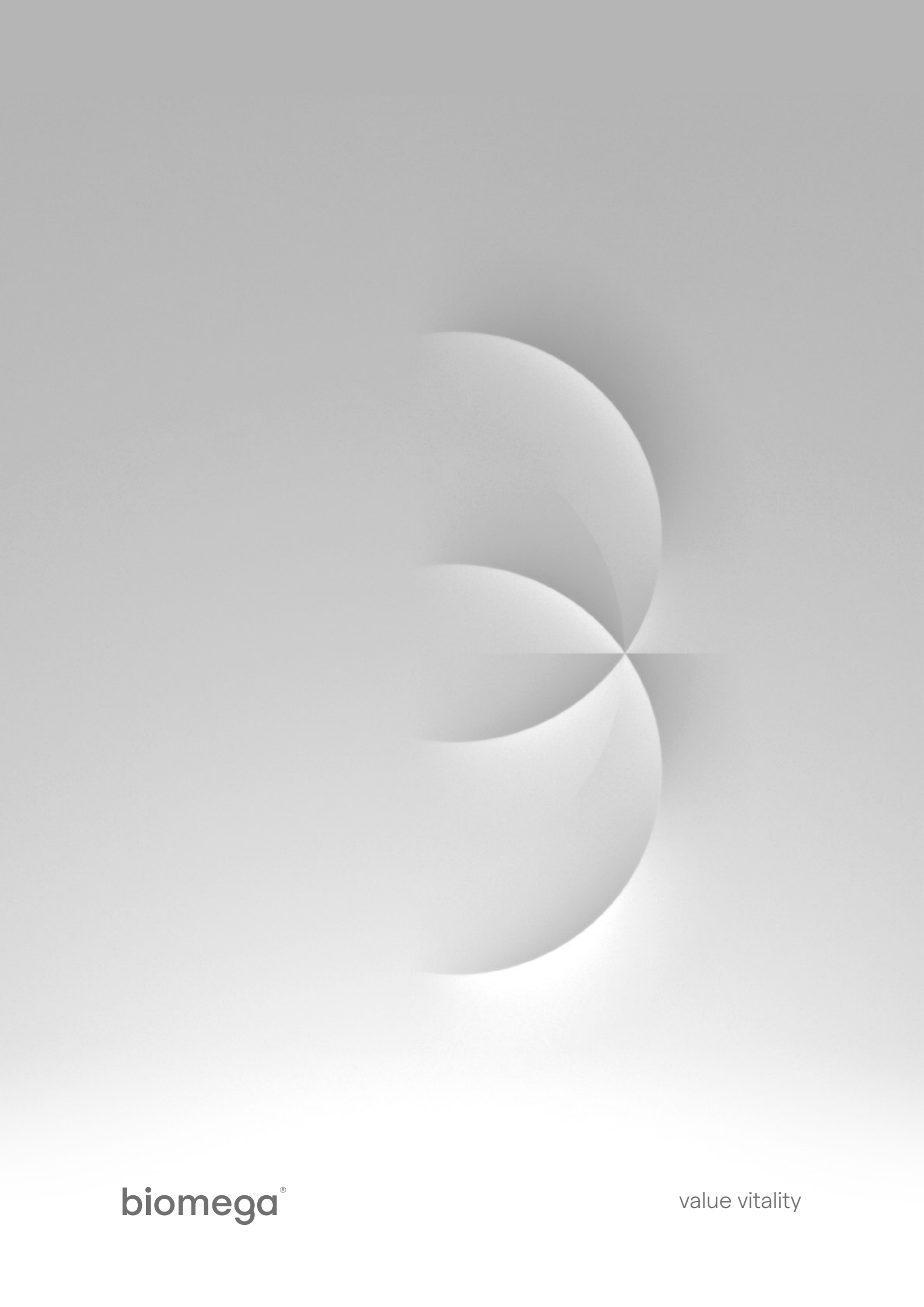
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