

**OPTIMIZING ZINC FORMULATIONS:**

**SELECTING THE IDEAL INGREDIENTS BASED ON  
DIFFERENT APPLICATIONS, FROM GUMMIES TO CAPSULES**

**THE IMPORTANCE OF ZINC AFTER COVID-19**

**WHITE PAPER**

This white paper will discuss the importance of zinc for human health and why it is crucial to use highly bioavailable and high-quality zinc in nutraceuticals, infant nutrition, sports nutrition, food and beverages. Zinc is an essential micronutrient that plays a vital role in numerous biological processes in the body, including immune function, DNA synthesis, wound healing, growth and development. However, many people do not consume enough zinc in their diet, which can lead to zinc deficiency and severe health consequences. This is where zinc food and dietary supplements, and fortified foods come in, but not all zinc supplements and fortified foods are created equal. The quality and bioavailability of the zinc used in these products can significantly impact their effectiveness. Therefore, using highly bioavailable zinc in these products is essential to ensure optimal health benefits.

This white paper will explore which zinc ingredient is better depending on the final product application, its importance for human health, and the benefits of using high-quality and highly bioavailable zinc in nutraceuticals, sports nutrition, infant formulas, food and beverages.

Zinc deficiency can have a wide range of adverse effects on human health. These include facial and hand eczema, hair loss, reproductive organ defects, delayed sexual maturation, menstrual irregularities, growth disorders, and impaired mental development. Additionally, zinc deficiency may lead to postnatal depression, loss of taste or smell, anemia, poor appetite, poor circulation, nerve damage, white spots on the nails, increased susceptibility to infections, impaired wound healing, and impotence in men. It is important to note that the body does not have a specialized "zinc storage" system, which means that a daily zinc intake is required to maintain adequate levels in the body.

### GADOT'S ZINC INGREDIENTS:

	ZINC CITRATE	MICRONIZED ZINC CITRATE	ZINC GLUCONATE
Zinc Content	31-33%	31-33%	12.5-14.6%
Solubility	0.3%	0.3% Dispersible	>10%
pH	Neutral	Neutral	5.5-7.5
100% RDA equal to, mg	35 mg	35 mg	82 mg
Taste, Mouthfeel	Neutral Sandy	Neutral	Typical Zn Aftertaste

#### Bioavailability Issue:

"Zinc Absorption by Young Adults from Supplemental Zinc Citrate Is Comparable with That from Zinc Gluconate and Higher than from Zinc Oxide," states Wegmuller et al, The Journal of Nutrition, Volume 144, Issue 2, 1 February 2014, Pages 132-136

### HOW TO CHOOSE THE BEST SUITABLE TYPE OF ZINC?

Choosing the best suitable zinc depends on the application



#### Tablet dosing form and Hard Capsules:

In this case, properties such as taste profile, pH, and solubility are unnecessary. The most critical parameters are bioavailability and Zinc content. Based on it – the best suitable is Zinc Citrate.



#### Effervescent tablet:

The situation is similar to Zinc Gluconate Chewable Tablet. Still, as the tablet will be dissolved in a relatively big amount of water (usually a glass of water), the dilution factor will modify the strength of the taste issue.



#### Mouthwash:

As they usually are neutral pH, there are two possible candidates – Zinc Gluconate and Zinc Citrate Micronized.



#### Gummies:

Micronized Zinc Citrate is the best as it does not modify water activity during preparation as an insoluble product. Since the required dosage of Zinc is relatively low, soluble Zinc can also be used – Zinc Gluconate.



#### Moist Wipes:

Those well-known to everybody small moist wipes are used by everybody in modern life for cleaning and sanitizing skin or surfaces on a daily basis. As a matter of fact, the composition of such moist wipes also comprises Zinc Gluconate solution.



#### Chewable Tablet dosing form:

In this case, solubility and taste become necessary as the tablet disintegrates in the oral cavity and taste receptors are directly in contact with the product. The best option is Zinc Gluconate, which is soluble, has a better mouthfeel and is more pleasant to the taste receptor when other ingredients are added. Zinc Gluconate has no acidity issue when adding Vitamin C, but more flavor has to be incorporated to overcome the Zinc taste.



#### Tooth Paste:

Solubility is unnecessary for such application, so the best suitable is Micronized Zinc Citrate with the benefits of high Zinc content and the absence of sandy mouthfeel.



#### Syrups:

For this application, high solubility is required. The best is Zinc Gluconate. There are additional applications for Zinc salts besides dietary supplements, food, infant nutrition, and oral care. Below is a description of the application, utilizing high solubility and neutral pH of Zinc Gluconate for moist wipes.

#### Zinc Gluconate has high elasticity properties.

It forms a protective layer on the skin and is an excellent barrier, protecting it from moisture while encouraging the natural regeneration process. Additionally, zinc is used for pet health, especially oral care to eliminate "doggy breath" and sanitary wipes for dermatitis treatment in dogs.



## ZINC CLAIMS, ACCORDING TO EFSA (EU)

The European Food Safety Authority (EFSA) has evaluated several health claims related to zinc and has provided scientific opinions on their validity. Here are some of the claims that EFSA has evaluated:

- 1** Zinc contributes to normal DNA synthesis: EFSA has concluded that a cause-and-effect relationship has been established between zinc consumption and normal DNA synthesis.
- 2** Zinc contributes to normal cognitive function: EFSA has concluded that a cause-and-effect relationship has been established between zinc consumption and normal cognitive function.
- 3** Zinc contributes to normal fertility and reproduction: EFSA has concluded that a cause-and-effect relationship has been established between zinc consumption and normal fertility and reproduction.
- 4** Zinc contributes to the maintenance of normal bones, hair, nails, and skin: EFSA has concluded that a cause-and-effect relationship has been established between the consumption of zinc and the maintenance of normal bones, hair, nails, and skin.
- 5** Zinc contributes to the normal function of the immune system: EFSA has concluded that a cause-and-effect relationship has been established between the consumption of zinc and the normal function of the immune system.
- 6** Zinc contributes to the protection of cells from oxidative stress: EFSA has concluded that a cause-and-effect relationship has been established between the consumption of zinc and the protection of cells from oxidative stress.

It's important to note that these claims are based on the consumption of zinc through the diet and not through supplementation. EFSA has also established safe upper limits for zinc intake, and consuming too much zinc can have negative health effects.

## EU – ZINC RECOMMENDED DOSAGE

The daily recommended dosage of zinc in the European Union (EU) varies depending on factors such as age, sex, and pregnancy status. However, the European Food Safety Authority (EFSA) recommends a daily intake of 10 milligrams of zinc for adult men and 7 milligrams for adult women. Pregnant and breastfeeding women are advised to consume slightly higher amounts, with a recommended daily intake of 9 milligrams and 10 milligrams, respectively. It is important to note that exceeding the safe upper limit of zinc intake (25 milligrams per day for adults) can lead to adverse health effects, such as nausea, vomiting, and diarrhea.



## ZINC CLAIMS, ACCORDING TO FDA (USA)

The U.S. Food and Drug Administration (FDA) allows for certain health claims related to zinc to be made on food and dietary supplement labels. Here are some of the claims that are allowed by the FDA:

- 1** Zinc is essential for human health: The FDA allows the statement "Zinc is essential for human health" to be made on food and dietary supplement labels.
- 2** Zinc helps support a healthy immune system: The FDA allows the statement "Zinc helps support a healthy immune system" to be made on food and dietary supplement labels.
- 3** Zinc helps maintain healthy skin: The FDA allows the statement "Zinc helps maintain healthy skin" to be made on food and dietary supplement labels.
- 4** Zinc helps maintain healthy hair: The FDA allows the statement "Zinc helps maintain healthy hair" to be made on food and dietary supplement labels.
- 5** Zinc helps maintain healthy nails: The FDA allows the statement "Zinc helps maintain healthy nails" to be made on food and dietary supplement labels.

It is important to note that these claims are allowed by the FDA as long as they are accompanied by a disclaimer that states that the FDA has not evaluated the claim and that the product is not intended to diagnose, treat, cure, or prevent any disease. Additionally, the FDA has established a daily value (DV) for zinc intake, and food and dietary supplement labels must indicate the amount of zinc contained in the product as a percentage of the DV.

## USA - ZINC FDA RECOMMENDED DOSAGE

RECOMMENDED DIETARY ALLOWANCES (RDAs) FOR ZINC				
	MALE	FEMALE	PREGNANCY	LACTATION
0-6 months	2 mg*	2 mg*		
7-12 months	3 mg	3 mg		
1-3 years	3 mg	3 mg		
4-8 years	5 mg	5 mg		
9-13 years	8 mg	8 mg		
14-18 years	11 mg	9 mg	12 mg	13 mg
19+ years	11 mg	8 mg	11 mg	12 mg

\*Adequate Intake (AI)

**From:** Institute of Medicine, Food and Nutrition Board. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. Washington, DC: National Academy Press, 2001.

11 mg of Zinc (1 RDA) is equal to 34.4 mg of Zinc Citrate

### RDA: 11 mg Zinc (FDA, March 2020)

GADOT is a manufacturer of **Zinc Citrate**, **Zinc Gluconate**, and **Zinc Phosphate** in different granulations to best fit the formulations for nutraceutical, food, dietary supplements, sports nutrition, infant nutrition and beverage applications.

#### ZINC CITRATE

Zinc Citrate produced by Gadot is Halal and Kosher certified.

**CAS Number:** 546-46-3

**Molecular formula:** Zn<sub>3</sub>(C<sub>6</sub>H<sub>5</sub> O<sub>7</sub>)<sub>2</sub>3H<sub>2</sub> O

#### ZINC GLUCONATE

Suitable for zinc enrichment for food, beverage and dietary or food supplement formulations.

Zinc Gluconate manufactured by Gadot with CAS Number and Molecular formula is Halal and Kosher certified and is convenient for dietary supplements, personal care.

**CAS Number:** 4468-02-4 (Anhydrous form).

**Molecular formula:** C<sub>12</sub>H<sub>22</sub>ZnO<sub>14</sub>

#### TRI ZINC CITRATE

**TRI ZINC CITRATE TRIHYDRATE:**

**CAS Number:** 178326-57-3

**Molecular formula:** Zn<sub>3</sub>(C<sub>6</sub>H<sub>5</sub> O<sub>7</sub>)<sub>2</sub>3H<sub>2</sub> O

**TRI ZINC CITRATE DIHYDRATE:** is an odorless White powder mainly used for Oral care products, dietary or food supplements, and fortifying food with zinc.

**CAS Number:** 5990-32-9

**Molecular formula:** Zn<sub>3</sub>(C<sub>6</sub>H<sub>5</sub> O<sub>7</sub>)<sub>2</sub>2H<sub>2</sub> O

#### TRI ZINC PHOSPHATE TETRAHYDRATE

Is an optimal ingredient for Dental care. Kosher and Halal, HACCP and GMP.

**CAS Number:** 7543-51-3

**Molecular formula:** Zn<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>\*4H<sub>2</sub> O

Gadot Product Grade	Zn %	Recommended Application
Tri Zinc Citrate	32	Gummies, tablets, chewables, dental care
Tri Zinc Citrate M15	32	Gummies, capsules, dry mixes, infant nutrition
Zinc Gluconate Powder	13	Personal care, dietary supplements
Zinc Phosphate M10	40	Paints, oral care, adhesives

The United States Food and Drug Administration (FDA) does not provide specific daily recommended nutrient dosages, including zinc. However, the FDA does regulate the use of zinc in dietary supplements and sets a daily upper limit of 40 milligrams for adults to prevent the risk of adverse effects. It is important to note that dietary supplements should not replace a healthy and balanced diet, and individuals should consult with a healthcare professional before taking any supplements, including zinc.

In the United States (USA), zinc's recommended daily allowance (RDA) varies based on age, sex, and pregnancy status. According to the National Institutes of Health (NIH), the RDA for adult men is 11 milligrams, while adult women are advised to consume 8 milligrams daily. Pregnant and breastfeeding women require higher amounts, with a recommended daily intake of 11-12 milligrams and 12-13 milligrams, respectively. The safe upper limit of daily zinc intake for adults in the USA is 40 milligrams daily. It is important to note that exceeding the safe upper limit can lead to adverse health effects, such as copper deficiency and immune system suppression.

