

## Comparison of Nutritional Value of Salmon and Sturgeon Caviar

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**Abstract:** This review examines the differences in physical and nutritional properties of sturgeon and salmon caviar. When reviewing their physical characteristics, sturgeon caviars are characterized as smaller and blackish roes, while salmon caviars are described as more prominent and reddish-hued roes. There is no similarity between salmon caviar and sturgeon caviar in terms of color and size. Considering the nutritional value, salmon roe has a higher protein composition than sturgeon roe. Although sturgeon caviar has a higher total lipid composition, salmon caviar has higher omega-3 polyunsaturated fatty acids (PUFAs) like EPA and DHA. Salmon caviar, which is a caviar substitute, has a more favorable profile in terms of nutrition. Additionally, it appears to be a cheaper alternative for caviar consumption.

**Keywords:** Caviar; sturgeon; salmon; fatty acid; protein © 2024 ACG Publications. All rights reserved.

### 1. Introduction

"Caviar" is the salt-cured, unfertilized egg obtained from various sturgeon species. It has a distinguished status as one of the rarest and most valuable fish products. Its global popularity is due to its high nutritional value, containing abundant high-quality protein with polyunsaturated fatty acids (PUFAs). Beluga (*Huso huso*), Osetra (*Acipenser gueldenstaedtii*), Imperial (*A. persicus*), and Sevruga (*A. stellatus*) roes obtained from distinct wild Caspian and Black Sea sturgeon species are among the most recognized and valued caviar types [1-4].

However, caviar production has not met consumer demand due to the slow maturation of sturgeon species. Therefore, it has led to the emergence of its substitutes [5]. These more affordable substitutes aim to address concerns about protecting sturgeon species and encourage the consumption of fish roe products. According to the United States Customs Service report (2008), these substitutes are processed roe obtained from non-sturgeon fish, such as salmon [6-7].

Caviar obtained from salmonoid fish roe is known as "salmon caviar" and is one of the most popular substitutes for sturgeon roe. Salmon caviar is reddish and more prominent. It also offers a milder taste than sturgeon caviar because it is processed with less salt. Salmon caviars are mainly produced from pink salmon (*Oncorhynchus gorbusha*), chum salmon (*O. keta*), Atlantic salmon (*Salmon salar*), and rainbow trout (*O. mykiss*) [8-9]. Figure 1 shows caviar from sturgeon species and salmon caviar from salmonoid species. This review investigated and compared the nutritional value and physical properties of roes obtained from sturgeon and salmonoid species.

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**Figure 1.** Sturgeon and salmonoid fishes; caviar and salmon caviar

## 2. Physical Characteristics of Sturgeon and Salmon Roes

The dimension and size of fish roes are widely acknowledged as a critical physical attribute. The size of fish roe demonstrates variances between distinct fish species and within the confines of the same species [9]. The diameter size of sturgeon roes typically ranges from 2.1 to 4.51 mm, whereas the size of salmon roe exhibits 4.47 to 8.6 mm. Remarkably, salmon roe tends to be nearly twice the size of sturgeon roe, as seen in Table 1.

**Table 1.** Roe sizes (mm, diameter) of Sturgeon and Salmonoid species [4-8]

<i>Sturgeon Roe</i>		<i>Salmon Roe</i>	
Sevruga ( <i>Acipenser stellatus</i> )	2.1-2.85	Chum salmon ( <i>Oncorhynchus keta</i> )	7.9-8.6
Osetra ( <i>Acipenser gueldenstaedti</i> )	2.36-3.94	Pink salmon ( <i>Oncorhynchus gorbuscha</i> )	6.9-7.2
Beluga ( <i>Huso huso</i> )	2.83-4.51	Atlantic Salmon ( <i>Salmon salar</i> )	5.52-6.33
Imperial ( <i>Acipenser percicus</i> )	2.98-4.46	Rainbow Trout ( <i>Oncorhynchus mykiss</i> )	4.47-4.61

## 3. Nutritional Value of Sturgeon and Salmon Roes

### 3.1. Protein Composition

Fish roe is considered an essential source of high-quality protein [9]. According to the literature results (Figure 2), sturgeon roe has a 14.84 - 24.2% protein composition. Salmon roe is between 27.5 - 30.4%. Among the salmon roe species, the lowest protein value (27.5%) is the Atlantic salmon roe. Among the Sturgeon roe species, the highest protein value (24.2%) is the Imperial roe. Interestingly, even the lowest value of salmon roe is higher than that of sturgeon roe. Additionally, a study was conducted on the protein composition of sturgeon roe and salmon roe [10]. This research identified protein solubility in fish roe products as a crucial index for predicting their functional properties and potentially their biochemical or microbiological stability. The salt-soluble proteins accounted for 86.1% and 84.2% of the recovered protein in sturgeon and salmon roes, respectively. The protein

### Nutritional value of salmon and sturgeon caviar

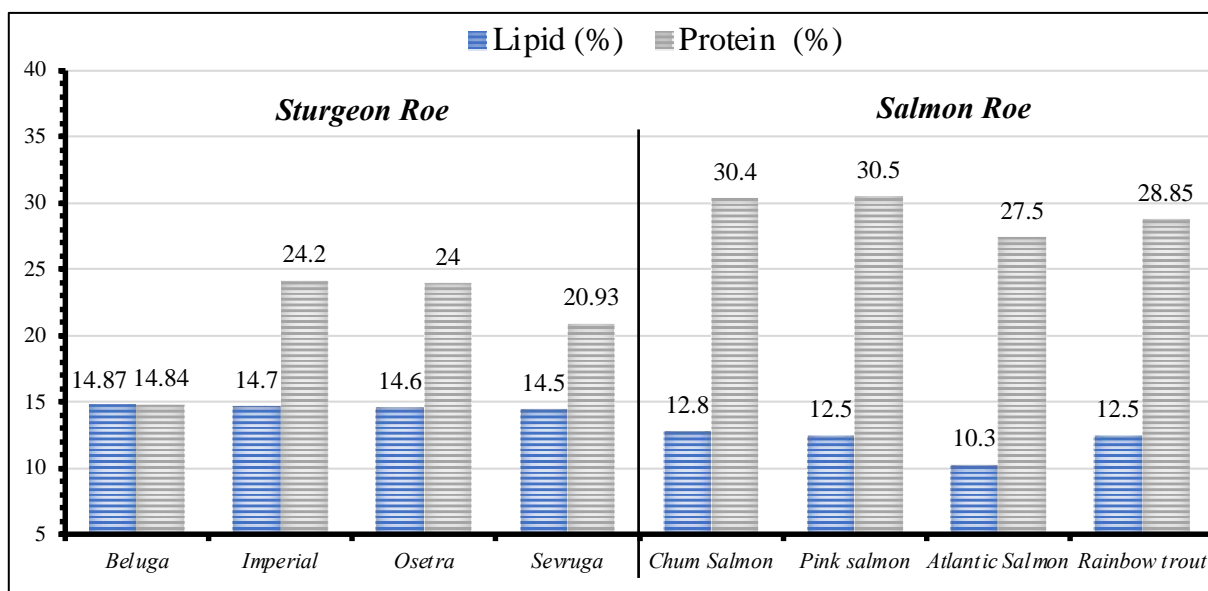
electrophoretic pattern of sturgeon roe revealed vitellin and ovomucoid or phosvitin as the most prominent proteins, while in salmon roe, small proteins like lysozyme or phosvitin were identified [10].

#### 3.2. Lipid Composition

According to the literature results (Figure 2), the total lipid composition in sturgeon caviar varies between 14.5 and 14.87%. In contrast, salmon roe is observed to have a lower total lipid composition, ranging between 10.3-12.8%. Oleic acid (Omega-9) is determined as the dominant fatty acid in the lipid composition of sturgeon roe. Beluga contains high levels of oleic acid (42.9%), which is known for its reported health benefits, including reduced risk of coronary heart disease by lowering low-density lipoprotein-cholesterol, relieving inflammation, oxidative stress and blood pressure, and decreased risk of cardiovascular diseases [11-12].

Fish roe is also rich in omega-3 PUFAs, such as docosahexaenoic acid (22:6n-3, DHA) and eicosapentaenoic acid (20:5n-3, EPA) [9, 13]. DHA composition varies between 7.6-13% for sturgeon roe and 13.36-27.2% for salmon roe. Additionally, EPA composition ranges from 3.2-9.2% for sturgeon roe and 9.7-15.41% for salmon roe. The results of the literature show that EPA and DHA fatty acids are higher in salmon roe. Both DHA and EPA reduce the risk of cardiovascular disease by lowering blood triglyceride levels and blood pressure, showing various biological effects; including some of the benefits are lower chances of developing heart problems, having less cholesterol in the blood, preventing blood clots, and reducing inflammation and swelling. [14-15].

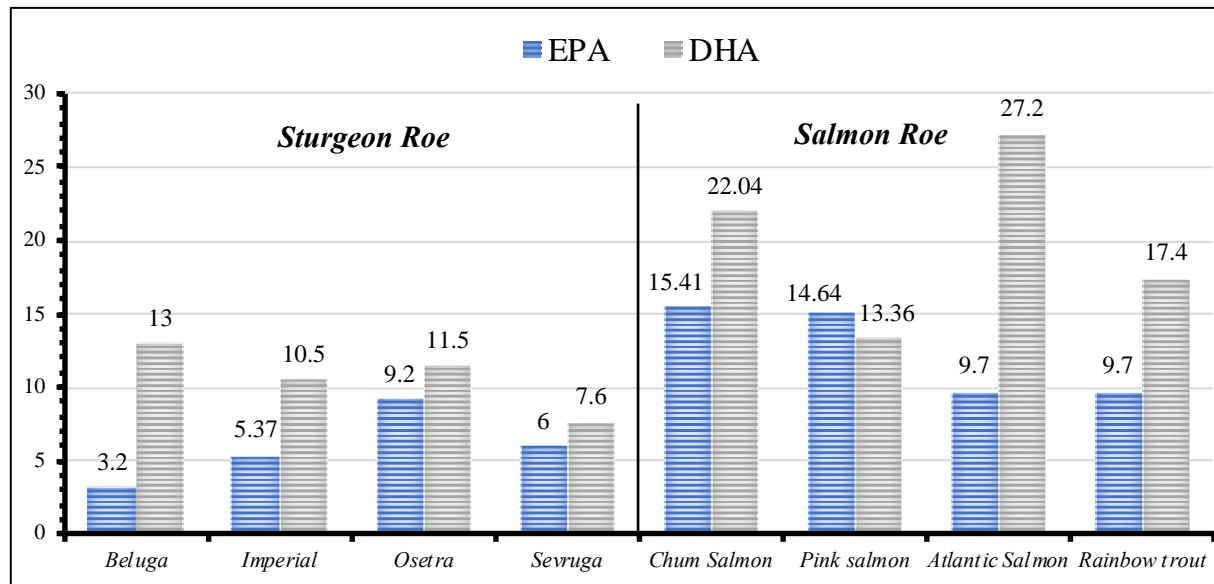
As a result, although sturgeon roes have a higher lipid composition and Omega-9 fatty acid, salmon roe has an advantage in terms of PUFAs. It's important to note that Omega-9 is not considered an essential fatty acid, as the human body can synthesize it independently. Therefore, it is crucial to obtain critical omega-3 and omega-6 acids from external sources [16]. Since salmon caviar has higher levels of these essential acids, it appears to be in a more advantageous position than sturgeon caviar in terms of nutritional benefits. Numerous studies have reported substantial differences in the fatty acid composition and lipid classes of roe in different fish species depending on factors such as fish species, season, diets, developmental stage, and environmental conditions [17].



**Figure 2.** Protein and lipid composition of Sturgeon and Salmon Roes [18-24]

**Table 2.** Fatty acid profile of sturgeon and salmon roes [17, 21, 25, 29]

	Oleic acid (18:1n-9)	Linoleic acid (18:2n-6)	Arachidonic acid (20:4n-6)	EPA (20:5n-3)	DHA (22:6n-3)	$\Sigma$ n-3	$\Sigma$ n-6
<b>Sturgeon Roe</b>							
Beluga	42.9	1.9	2.2	3.2	13.0	21.1	5.4
Imperial	30.97	1.10	0.24	5.37	10.50	16.46	4.58
Osetra	36.9	0.8	2	9.2	11.5	24.5	4.7
Sevruga	36.8	1.6	2.5	6.0	7.6	17.4	6.4
<b>Salmon Roe</b>							
Chum salmon	18.25	1.32	1.42	15.41	22.04	47.88	3.19
Pink salmon	21.84	1.57	2.14	15.09	13.36	36.34	4.9
Atlantic salmon	10.4	3.1	1.6	9.7	27.2	47.7	7.7
Rainbow trout	20.1	4.9	1.6	9.7	17.4	31.2	6.5

**Figure 3.** EPA and DHA composition of sturgeon and salmon roes [6, 17, 21, 26-32]

Sturgeon caviar has widespread popularity and high cost. However, it has been observed that salmon caviar is more advantageous than traditional sturgeon caviar in terms of both nutritional value and cost-effectiveness. According to study results in the literature, compared to salmon caviar obtained from salmon species and sturgeon caviar obtained from sturgeon species, it appears to have higher omega-3 PUFA such as DHA and EPA with protein composition. Sturgeon caviar can be characterized by its higher lipid composition and dominance in Omega-9 fatty acids. However, when considering essential fatty acids, the higher levels of Omega-3 and Omega-6 in salmon caviar provide health advantages. These crucial fatty acids are associated with various health benefits, particularly a reduced risk of cardiovascular disorders. While sturgeon caviar maintains its respected status, salmon caviar is emerging as potentially more advantageous. It could also be an opportunity for sturgeon species extinction concerns and conservation efforts. In addition to personal consumption preferences and habits, this review recommends its consumption as a cheaper and more accessible caviar.

## Nutritional value of salmon and sturgeon caviar

**Conflict of Interest**

The authors declared no potential conflicts of interest concerning the publication of this article.

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