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# Unveiling Regional Dynamics and Factors Influencing Fish Purchase and Consumption in Odisha, India

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## Abstract

Despite India being a major global fish producer, per capita fish consumption remains notably low in several regions, raising concerns regarding the nutritional adequacy of diets. This study explores the factors influencing fish purchase and consumption patterns in the Cuttack and Khordha districts of Odisha, India. A comprehensive survey (n=400) was conducted, and a trans-regression analysis was applied to identify key factors. The results reveal that fish quality, with an emphasis on freshness, taste, and texture, is the most crucial factor influencing consumer preferences in both districts. Affordability, represented by fish prices, ranked second, while dressing facilities unexpectedly held significant importance, reflecting consumer preference for convenience in fish preparation. Sociocultural factors, including local traditions and dietary customs, also played a role but were less significant compared to other factors. The study highlights a promising trend of fish consumption exceeding recommended levels, contributing positively to nutritional goals. A comparative analysis between regions showed variability in meat consumption, with fish standing out as a primary dietary staple. These findings underscore the need for regionspecific strategies to promote sustainable fish consumption, considering both economic and sociocultural influences. The study contributes to the understanding of regional variations in fish consumption patterns and provides a foundation for targeted interventions to address nutritional challenges and promote sustainable dietary practices.

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## Introduction

Fish and aquatic resources serve as crucial contributors to sustaining livelihoods and providing nutritious, sustainable diets for millions globally (UN Nutrition, 2021; Von Braun, Afsana, Fresco, Hassan, & Torero, 2021). In economically challenged regions across Africa, Asia, and the Pacific, fish represent a primary source of animal-sourced protein (FAO, 2020) and play a vital role in maintaining a healthy diet. Rich in essential amino acids, unsaturated fats, calcium, phosphorous, and vitamins A and D, fish is a cost-effective, high-quality protein source (Craig, Helfrich, Kuhn, & Schwarz, 2017). Extensive studies have explored the significance of fish in human nutrition, emphasizing their role in preventing various health conditions, including cardiovascular diseases, high blood pressure, elevated cholesterol, Alzheimer's disease, and certain cancers (Balami, Sharma, & Karn, 2019). In particular, oily fish, which are abundant in omega-3 fatty acids, not only enhance brain function but also reduce the risk of heart attacks, strokes, and osteoporosis. The inclusion of fish in one's diet has shown tangible benefits for physical well-being, slowing the aging process, aiding weight loss by suppressing hunger hormones, and promoting a more balanced and nutritious dietary intake (HLPE, 2017).

India shares 8.92% of total global fish production at an all-time high of 175.45 lakh metric tons (2022-23) with an average annual growth rate of 7.98% (DoF, GoI, 2023). However, per capita fish consumption among its citizens remained notably low at around 5 kg per year. This figure is strikingly minimal, representing just a quarter of the global average, and positioning India among the countries with the lowest rates of fish consumption globally (FAO, 2021). The annual per capita consumption of fish for

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the fish-eating population of India has increased to 12.33 kg in 2021-22 (Padiyar et al., 2024). While academic attention on food and nutrition security has traditionally focused on agriculture and alternative animal protein sources, fishery experts emphasize the critical role of fish production and management. Although India is a leading producer of fish globally, there is a significant lack of awareness about the critical role fisheries play in ensuring food and nutritional security. This gap in understanding presents a major challenge for the country, which faces high rates of child malnutrition, as evidenced by the Global Nutrition Report-2018 that highlights the prevalence of wasting and stunting among children (Fanzo et al., 2019).

Various factors, including religious beliefs, pricing, convenience, accessibility, availability, and dietary attributes, significantly influence the landscape of fish consumption and individual preferences (Liu et al., 2018; Wenaty, Mabiki, Chove, & Mdegela, 2018; Sajeev, Mohanty, Sajesh, & Rejula, 2019). The pricing of fish is determined by factors such as market structure, species quality, demand, and size and weight of the fish. In turn, consumers consider factors such as freshness and shelf life when making purchasing decisions (Husen, 2019; Bhandari et al., 2021). Sensory aspects such as freshness, taste, and odour, along with non-sensory factors such as personal behaviour and beliefs, play crucial roles in shaping fish preferences (Rahman & Islam, 2020). Additionally, research indicates that households with ponds tend to exhibit a significantly higher frequency of fish consumption, particularly small indigenous species (SIS), with a notable 97% increase compared with households without ponds (Diana, Pandit, & Shrestha, 2016). A survey in Tanzania highlighted that the consumers actively promote fishing and integrate fish into their diets for health reasons, encouraging family members, particularly children, to embrace fish as a nutritious food choice (Wenaty et al., 2018).

Given the significance of fish in addressing nutritional deficiencies and improving dietary habits, this study aims to explore the factors influencing fish purchase and consumption patterns in the Cuttack and Khordha districts of Odisha, India. Specifically, it seeks to identify the key determinants of fish consumption, examine regional variations in consumer preferences, and assess the sociocultural and economic factors shaping fish consumption behaviours. The insights generated will help inform strategies to promote sustainable fish consumption in these districts and similar landscapes.

#### Materials and Methods

The investigation into consumer purchase preferences and consumption patterns in the Cuttack and Khordha districts of Odisha in 2022 involved a comprehensive survey encompassing 200 respondents from each district. The survey employed a pretested questionnaire to gather information on various aspects, including species preferences, demographic characteristics, and behaviour related to fish purchase and consumption. A multistage sampling technique was used to gather data from 400 households, involving individual visits to each household.

Demographic variables such as age, gender, household income, education level, and family size were captured to assess their influence on fish consumption patterns. These factors were included to analyse how demographic profiles might explain variations in per capita fish consumption (PCFC) across districts, linking them to broader socioeconomic and cultural contexts. The collected datasets were subjected to descriptive statistical analyses to obtain meaningful insights into the data distribution.

Trans regression, or the TRANSREG procedure, a statistical technique to model relationships between variables by applying transformations to the data to improve the fit of a regression model was used in this study. It was used to decompose the variability in average fish consumption and identify the contribution of different factors, to better understand the determinants of fish consumption. Before fitting the trans-regression model, normality of the data was assessed using the Shapiro-Wilk test and histograms to ensure that the assumptions of normal distribution were met. For any non-normally distributed variables, appropriate transformations (e.g., logarithmic or square root) were applied to stabilize variance and achieve normality.

The trans-regression model was fitted to PCFC as a function of several influencing factors, including fish price, species availability, freshness, convenience of purchase, and dressing facilities, for each district. The coefficient of determination (R<sup>2</sup>) was used to assess the goodness of fit of the model. Once the model was found to adequately explain the variability in PCFC, utility scores were computed for each factor and ranked to identify the most significant influences on consumption behaviour. The multicollinearity is not a concern here, but interdependence among the input variables on PCFC was also taken into account to compute the utility % of each input variable on PCFC.

Comparative analysis of fish consumption between Cuttack and Khordha was performed, considering the impact of socioeconomic and cultural factors such as local dietary customs, income distribution, and access to markets. These factors were discussed in relation to the demographic profiles of each district to explain observed differences in fish consumption patterns.

## **Results and Discussion**

The demographic profile of fish consumers from the Cuttack and Khordha districts in Odisha revealed notable trends (Table 1). In terms of age, a significant portion of respondents in both districts falls within

the 33–55 year bracket, comprising 70% in Cuttack and 66% in Khordha. Family sizes predominantly ranged between four and six members, constituting 70% in Cuttack and 71.5% in Khordha. The educational background showed a higher percentage of graduates in Cuttack (50.5%) than in Khordha (37.5%), indicating a more educated population in Cuttack. This distinction may contribute to higher fish consumption, as more educated individuals tend to be more aware of the health benefits associated with fish consumption. Occupational patterns revealed further differences: while agriculture predominates in Cuttack (56%), Khordha has a more diverse occupational distribution, with 44.5% self-employed. This occupational diversity in Khordha may lead to varying consumption patterns due to differences in income stability, time availability, and lifestyle preferences. Annual income patterns also differ, with 47% of respondents in Cuttack earning below Rs. 1,09,500, compared to 38.5% in

Sl. No.	Cuttack (n=200)		Percentage (%)	Khordha (n=200)		Percentage (%)
1.	Age	< 33 years	16	Age	< 31 years	19
		33- 55	70		31-54	66
		>55 years	14		>54 years	15
2.	Gender	Male	13	Gender	Male	7
		Female	87		Female	93
3.	Family members	< 4	19.5	Family members	< 4	13
		4 - 6	70		4-6	71.5
		>6	11.5		> 6	15.2
4.	Education	Primary	36	Education	Primary	32
		Secondary	13.5		Secondary	28.5
		Graduation	50.5		Graduate	37.5
					PG	2
5.	Occupation	Agriculture	56	Occupation	Government	11
	of respondents	Labour	8	of respondents	Labourer	7
		Private job	18.5		Unemployed	4.5
		Govt job	14		Private	9
		Self-employed	3.5		Farming	24
					Self employed	44.5
6.	Annual income	< 109500	47	Annual income	< Rs. 1,98,000	38.5
		109500-230500	34		Rs.1,98,000-	41
		>230500			3,24,000	
			19		>Rs. 3,24,000	24.5
7.	Place of residence	Village	100	Place of residence	Village	100

Table 1. Profile of the fish consumers (n=400)

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Khordha earning below Rs. 1,98,000. This disparity suggests that income levels, a key socioeconomic factor, influence fish consumption behaviour, with higher income households in Khordha having more purchasing power, potentially leading to a greater variety in species consumed.

In terms of fish consumption, Table 2 shows that both districts exceeded the ICMR recommended annual fish consumption level of 12 kg. However, Cuttack exhibited a higher monthly per capita fish consumption (1.88 kg) compared to Khordha (1.69 kg). The more frequent consumption of fish in Cuttack (27.5% of respondents consuming fish multiple times a week) versus Khordha (13.5%) may be attributed to its predominantly agrarian economy. Agricultural households often rely on local food sources, including fish, as a staple part of their diet. In contrast, the diverse occupational landscape in Khordha may result in varying dietary habits, with consumers possibly opting for other meat types, such as chicken, which was more commonly consumed in Khordha (9.24 kg/year) compared to Cuttack (6.96 kg/year). Additionally, the absence of beef consumption in Cuttack could be influenced by cultural and religious practices that prohibit the consumption of beef, while Khordha recorded minimal consumption (0.03 kg/person/month), likely due to less stringent cultural restrictions in some areas. These findings reflect the influence of both economic and cultural factors on consumption patterns.

In Cuttack, the most purchased and consumed fish species were Rohu (100%), Catla (95%), Mrigal (75%), Tilapia (10%) and Magur (10%) (Fig. 1). Conversely, in Khordha (Fig. 3), the prominent species purchased were Rohu (100%), Catla (100%), Mrigal (89%), Catfish (77%) and Bata (61%). Notably, the preferred species exhibited minimal variation from purchased ones, with Catla, Rohu, and Mrigal

being favoured by consumers in Cuttack (Fig. 2), mirroring the purchased patterns while in Khordha (Fig. 4), consumers favoured Catla, Rohu, Mrigal, Mola, Sardines and Bhakura. The fish species preferred in both districts show considerable overlap, with Rohu, Catla, and Mrigal being the most commonly consumed species in Cuttack and Khordha. However, Khordha displays a greater variety of species consumed, such as catfish and Bata.

This variation in species preference could be tied to the geographic and cultural differences between the two districts. Khordha, being closer to coastal areas, may have easier access to a wider range of freshwater and marine fish species, whereas Cuttack's reliance on locally available fish, predominantly from inland waters, may explain the more limited variety. This alignment between preferences and purchases aligns with findings from Rahman and Islam (2020) and Shovon, Majumdar, and Rahman (2017), who identified Rohu, Magur, Pangas, Hilsa, and Tilapia as preferred species. Additionally, Sajeev et al. (2021a) highlighted the tribal population's affinity for Sardine in Wayanad, Kerala; Mackerel and Sardine by the Koraga tribes and Tilapia and Catla among Soliga tribes in Karnataka (Sajeev, Ramesha, Chethan, & Gopika, 2023a). Sardines and mackerel were the most preferred fishes by consumers of Malappuram, Kerala (Sajeev et al., 2022). Majagi and Somashekar (2020) reported Catla, Rohu, and Mrigal as commonly consumed freshwater fishes in Karnataka while Sardine and Mackerel were the major marine fish consumed. These insights underscore the regional variations in fish preferences and consumption habits, offering a better understanding of the diverse dietary choices among different populations.

The results of the trans-regression test further illuminate the factors influencing fish consumption

Sl.		Khord	ha	Cut	ttack
No	Meat consumed	Kg/month	Per capita cons <sup>.</sup> Kg/year	umption (kg) Kg/month	Kg/year
1.	Fish	1.69	20.28	1.88	22.56
2.	Chicken	0.77	9.24	0.58	6.96
3.	Beef	0.03	0.36	-	-
4.	Mutton	0.15	1.8	0.334	4.008

Table 2. Per capita consumption of fish and other meat among Khordha and Cuttack consumers (n=400)

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Fig. 1. Fish sp. consumed most (Cuttack)



Fig. 3. Fish sp. consumed most (Khordha)

in the two districts. In Cuttack (Table 3), the primary factors influencing fish consumption were fish quality (29.985%), price (19.558%), and convenience in cooking (15.463%), which points to a strong preference for high-quality, affordable fish that is easy to prepare. Given that Cuttack is largely an agrarian district, time constraints and affordability play key roles in shaping consumption habits. Consumers here prioritize quality and price, likely due to their relatively lower income levels and the need for nutritious, cost-effective food options.

In contrast, Khordha's consumers prioritized fish quality (19.062%), dressing facilities (14.352%), and price (9.113%) (Table 4). The high importance placed on dressing facilities in Khordha may be reflective of the district's more diverse occupational structure, where consumers may have less time or expertise to dress fish themselves, leading them to seek out



Fig. 2. Favourite fish sp. (Cuttack)



Fig. 4. Favourite fish sp. (Khordha)

pre-dressed options for convenience. The higher average incomes in Khordha may also allow consumers to spend more on such services. Additionally, the influence of production methods and fish origin (7.575% and 7.572% utility scores, respectively) suggests that consumers in Khordha may be more concerned about where their fish comes from, possibly due to increased awareness of sustainable fishing practices, which is often linked to higher educational levels and income.

Both districts accorded the highest priority to fish quality, aligning with previous studies such as Mugaonkar, Ananthan, Samal, and Debnath (2011); Prasad and Madhavi (2014) and Sajeev, Joshy, Debbarma, and Kumar (2023b), which emphasize the universal importance of freshness and quality in fish purchase decisions. In a study conducted in the Palakkad district of Kerala, Geethalakshmi,

#### Factors influencing fish purchase and consumption

The TRANSREG Procedure Hypothesis Test for Consumption					
	Factors	Utility			
Sl. No.	Intercept	6.2910 Importance (% Utility Range)	Rank		
1	Price of the fishes	19.558	2		
2	Availability of my favourite fishes	7.489	6		
3	Market accessibility	1.613	9		
4	Health benefits	2.221	8		
5	Safety of fish	9.228	4		
6	Quality of fish	29.985	1		
7	Convenience perception: Easiness of cooking	15.463	3		
8	Sensory perception: Feel of fish in my hand	0.755	11		
9	Knowledge of fish recipes	0.679	13		
10	Place of origin of fish (Inter/intra state/national)	2.445	7		
11	Source of fish (marine/freshwater)	0.699	12		
12	Production method (capture/farmed)	0.200	15		
13	Information on fish sold in market	0.314	14		
14	Availability of dressing facility	1.278	10		
15	Availability of home delivery	8.074	5		

Table 3. Factors influencing the purchase and consumption of fish by consumers in Cuttack (n=200)

The standard errors are not adjusted for the fact that the dependent variable was transformed and so are generally liberal (too small). R-Square 0.7406

Ashaletha, Raj, and Nasser (2013) found that quality stands out as the most crucial attribute shaping consumer behaviour in the context of fish consumption. Addressing similar concerns, Birch, Lawley, and Hamblin (2012) identified freshness and quality as key barriers to fish purchase. This collective body of research underscores the consistent recognition of fish freshness and quality as fundamental elements shaping consumer attitudes and behaviours in diverse geographical and cultural settings. The findings also align with the broader literature on fish consumption factors, in which high price perception and lack of convenience hinder consumption tendencies (Carlucci et al., 2015). Nayga and Capps (1995) highlighted a negative relationship between fish consumption and price, while Kiziloðlu and Kizilaslan (2015) found a proportional relationship in a different study.

However, the differences in the ranking of other factors—particularly convenience-related aspects like dressing facilities in Khordha—highlight how regional socioeconomic contexts shape consumer preferences. In this context, the relatively higher demand for convenience services in Khordha may be linked to the district's more urbanized, serviceoriented economy compared to the predominantly agrarian Cuttack. Convenience perception, identified as an important factor aiding fish purchases in Cuttack and Khordha, resonates with observations of Brunsø, Verbeke, Olsen, and Jeppesen (2009) and Sajeev et al. (2021b) that convenience has gained increasing importance in the face of consumers' time constraints and need for reduced mental exertion during the meal acquisition process.

Consumers in Cuttack as well as Khordha accorded highest priority for fish quality. Sajeev et al. (2021a); Sajeev et al. (2022) and Sajeev et al. (2023a) also identified the importance of quality of fish and price of fish among purchase decision of fish consumers in Kerala and Karnataka. Moreover, factors such as price, smell during fish preparation, and a sense of insufficient fullness were identified as deterrents to fish consumption, echoing the findings of previous studies (Trondsen, Scholderer, Lund, & Eggen,

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The TRANSREG Procedure Hypothesis Test for Consumption					
	Factors	Utility			
Sl. No.	Intercept	6.2910 Importance (% Utility Range)	Rank		
1	Price of the fishes	9.113	3		
2	Availability of my favourite fishes	1.586	15		
3	Market accessibility	2.975	13		
4	Health benefits	4.019	10		
5	Safety of fish	3.009	12		
6	Quality of fish	19.062	1		
7	Convenience perception: Easiness of cooking	2.736	14		
8	Sensory perception: Feel of fish in my hand	3.856	11		
9	Knowledge of fish recipes	5.945	8		
10	Place of origin of fish (Inter/intra state/national)	7.572	5		
11	Source of fish (marine/freshwater)	5.594	9		
12	Production method (capture/farmed)	7.575	4		
13	Information on fish sold in market	6.538	6		
14	Availability of dressing facility	14.352	2		
15	Availability of home delivery	6.069	7		

Table 4. Factors influencing the purchase and consumption of fish by consumers in Khordha (n=200)

The standard errors are not adjusted for the fact that the dependent variable was transformed and so are generally liberal (too small). R-Square 0.6277

2003). Issues such as inadequate fresh fish supply, erratic quality, limited product options, elevated prices, family aversions, and distaste for fish flavour have been identified as significant barriers to fish consumption (Trondsen et al., 2003; Olsen, 2004; Sajeev et al., 2021b). Olsen (2004) further emphasized that price, convenience, awareness, and accessibility of high-quality fresh products act as roadblocks for fish consumption in certain market segments, aligning with perceptions of elevated prices hindering seafood consumption in various European studies (Myrland, Trondsen, Johnston, & Lund, 2000; Verbeke & Vackier, 2005; Brunsø et al., 2009; Sajeev et al., 2021b).

These findings underscore the complex interplay of socioeconomic and cultural factors in shaping fish consumption patterns in Cuttack and Khordha. While both districts share some commonalities, such as a preference for certain fish species and a high regard for quality, differences in income, occupation, and cultural practices create distinct consumption behaviors. Policymakers and market players aiming to promote fish consumption in these regions must take these factors into account. For Cuttack, interventions could focus on ensuring the availability of affordable, high-quality fish, while in Khordha, there may be greater demand for services that enhance convenience, such as pre-dressing and improved market access including online vending. Additionally, public awareness campaigns could further promote the health benefits of fish, particularly in lower-income households in both districts, to encourage higher consumption.

Since quality being one of the most important factors affecting fish consumption, policy efforts to enhance fish consumption in Cuttack and Khordha and similar landscapes, should focus on improving fish quality through stricter handling and storage regulations. Affordable pricing can be encouraged by providing subsidies to small-scale producers and reducing intermediaries. Expanding access to fish dressing facilities will boost convenience, while educational campaigns can raise awareness of the nutritional benefits of fish. Promoting sustainable fisheries and aquaculture will ensure a steady supply of preferred species, supporting both dietary needs and local economies. Tailoring market strategies to regional preferences, with branding initiatives for popular fish like Rohu and Catla, will cater to local consumer tastes. Technology adoption, such as digital retail platforms and timely home delivery services, can improve market access. These measures will align with consumer preferences, ensuring a steady supply of affordable, high-quality fish while promoting sustainable fisheries and nutritional security in these districts.

In conclusion, this research delved into the intricacies of consumer purchase preferences and consumption patterns of fish in the districts of Cuttack and Khordha in Odisha. The findings revealed that the quality of fish, emphasizing freshness, taste, and texture, holds paramount importance for consumers in both Cuttack and Khordha. Affordability, indicated by the price of fishes, emerged as the second crucial factor. Interestingly, dressing facilities emerged as a surprisingly significant factor, underlining the convenience consumers place on having fish dressed at the point of purchase. Moreover, the research shed light on the promising trend of fish consumption surpassing recommended levels, contributing positively to nutritional goals. The comparative analysis of consumption patterns across regions highlighted the variability in meat consumption, with fish emerging as a key dietary staple. The insights of the study not only contribute to the understanding of consumer behaviour but also offer actionable recommendations for fisheries, markets, and policymakers helping them to align their strategies with the specific preferences of consumers in these districts and similar landscapes.

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