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Integrated assessment of work, socio-economic, and anthropometric parameters among women retailers of fresh and dry fish in Odisha

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Abstract

This study aims to examine the work, socio-economic status, and anthropometric profiles of fresh and dry fish retailers in the coastal districts of Ganjam and Puri in Odisha. The primary objectives of the study were to document and compare the work profiles of fresh and dry fish retailers; assess their socio-economic characteristics; and record the anthropometric indicators (height, weight, and Body Mass Index). A total of 60 fresh fish retailers and 60 dry fish retailers were selected from major fish markets. Data collection involved structured interviews using a pre-tested schedule and direct observation. Anthropometric data were measured using standard procedures. Statistical analyses, including independent samples t-tests and Chi-square tests, were applied to identify if there were significant differences between the two groups. The analysis revealed that the majority of respondents were in the 26-44 years age group. Most respondents were married and belonged to nuclear families from traditional fishing communities (Kaibarta/Nolia). Education levels were low, with a majority having only primary education or no formal schooling. Anthropometric assessments showed average body weight in range 56-57 Kg and height 156-157 cms. Body Mass Index was in normal range (22.76 for fresh and 22.9 for dry fish retailers). Statistical tests revealed no significant differences in age, weight, height, and BMI between the two groups ($p > 0.05$). In terms of work profile, both fresh and dry fish retailers worked approximately 8 hours daily in two shifts, beginning their day at 4:00 AM. The study concludes that fresh and dry fish retailers in Odisha share similar socio-economic and anthropometric profiles.

Keywords: Odisha, fisherwomen, work profile, anthropometry

1. Introduction

The FAO 2024 report highlights that the contribution of women in the fisheries sector is steadily increasing, especially in developing nations, where women make up nearly 50% of the workforce in small-scale fisheries value chains. It is well known that women play important roles in this sector and are engaged in a wide range of activities paid and unpaid in the pre-harvest, harvest, and post-harvest phases, including liaison work with institutions and agencies (ICSF, 2020) [1]. In India, women constitute around 50% of the total population and comprise one-third of the labour force. The socio-economic development of this vast population, therefore, assumes great importance in any developmental strategy. Women play a significant role in fishing communities along the country's extensive coastlines as well as in inland fishing villages. According to CMFRI (2010) [2], 5.4 million people are fully engaged in fisheries activities in India, including 3.8 million fishermen and 1.6 million fisherwomen. Women are particularly active in post-harvest fisheries in marine fishing, women comprise about 75% of the fish marketing workforce (ICSF, 2013) [3]. Their roles across states in India from Kerala and Tamil Nadu to Odisha, Gujarat, and inland states like Manipur and Assam have been recognized in numerous studies (Kruijssen *et al*. 2016; Nandeesha 2004; Nwabueze 2010; Choo *et al*., 2006; Gopal *et al*., 2012) [4, 5, 6, 7, 8]. Sharma (2007) [9] has emphasized that women's roles span all stages: pre-harvest, harvest, and post-harvest. Coastal fisher women are engaged in landing, processing, and marketing of fish across India. Activities such as net-making, bait preparation, fish drying, and vending are common. Yet, despite their essential roles, much of their labour is undervalued and often unrecognized. Fisherwomen are commonly seen in markets as retailers, operating from designated stalls or as head-loaders. Across coastal India, 50-70% of fisherwomen rely on fresh fish marketing and traditional fish processing for livelihood (Sudhakar *et al*., 2003) [10]. Gulati (1984) [11] observed that fisherwomen face both backwardness and gender discrimination. Srinath (2002) [12] further reported the adverse health impacts they endure from carrying head loads and competing with men using bicycles or scooters for vending. Despite their skill and resilience, the work of fisherwomen is often labelled "unskilled" due to a lack of formal education (Salim, 2013) [13]. Patnaik *et al*. (2011) [14] emphasized that their contributions remain largely invisible in official statistics. Conferences by the Gender in Aquaculture and Fisheries (GAF) forums have repeatedly recommended improved working conditions and visibility for women in fisheries.

A review of literature done on fisherwomen in Odisha revealed that there are a few studies done. Like Hota *et al*. (2014) [15] found that women in fish processing often work in squatting positions during tasks like peeling and grading, leading to joint pain and hand injuries due to repetitive motions. Singh *et al*. (2014) [16] highlighted that fish processing and marketing are primary occupations for coastal women, with secondary roles in shrimp units, poultry, farming, and more. In districts like Puri and Ganjam, over 50% of women are involved in fish procurement and sales, whereas this work is male-dominated elsewhere. CMFRI (2010) [2] reported that 18.08% of fisherwomen in Odisha are engaged in net making and repair, behind West Bengal (34.15%) and Maharashtra (19.21%). Chandra and Sharma (2015) [24] noted women's roles in drying, grading, prawn seed collection, and shell gathering in the Chilika lagoon. Nandeesha (2011) [5] estimated that about 30% of women in Odisha participate in carp culture. Das *et al*. (2022) [17] introduced labour-saving technologies like hand-operated descalers and mobile fish vending kiosks to SHGs in Jagatsinghpur, aiming to ease manual effort and boost efficiency. Ray (2013) [18] studied Chilika Lake fishers and highlighted the occupational risks from harsh environments, resource unpredictability, and perishability of fish. Prusty and Sharma (2019) [19] identified multiple hazards in Odisha's fresh and marine fisheries sectors.

It is clear from the studies that specific studies on Odisha's unique socio-economic context, particularly focusing on women workers, are lacking. Encouragingly, recent years have seen increased government focus on the empowerment and welfare of fisherwomen, with schemes targeting SHG formations, market development, and occupational safety gaining momentum.

However, in states like Odisha, limited research exists so this study addresses the work, socio-Economic, and anthropometric profile of fresh and dry fish retailers in Odisha.

Methodology

Odisha was selected as a locale of study as it is one of the important maritime states of India having excellent scope for fisheries development. Odisha ranks 4th in total fish production in India after Andhra Pradesh, West Bengal and Gujarat. The total fish production of Odisha during 2021-22 is estimated to be 989.8 million tons. It exports about 255.2 million tons to other countries and states during the year of 2021-22. It has been among the top fish-consuming states, with per capita annual consumption of 17.15 kg in 2021-22. The per-capita annual consumption of fish in the state has increased from 11.1 kg in 2014-15 to 17.2 kg in 2021-22. There has been a significant rise in total fish production in Odisha in the last decade. The overall fish production has increased from 873 thousand MT in 2020-21 to 990 thousand MT in 2021-22, registering a 13.4 per cent growth rate.

The state has highest number of fishing village i.e 813 and 3rd highest numbers of fisher folk population i. e. 15,17,574 after Tamil nadu and Kerala as per CMFRI census 2016. Among this, 5,96,155 marine fishermen and 9,21,419 inland fishermen. The total number of fisher women is 2,63,514. There are 63 numbers of marine Fish landing centres and 10 numbers of fish drying platform. Handbook of Fisheries Statistics (2020). In Odisha state, there are 6 maritime districts and for the current study Puri and Ganjam districts were selected as, in these two districts play major role in fish retailing activities where the activities of fisher women are significantly observed.

Justification for selecting Ganjam district

Among 30 districts of Odisha, Ganjam district is selected for the study due to its highest fisheries production. Besides, the majority of the fishing activities in this district are carried over by women as per District Fisheries Officer, CEO BFDA & FFDA, Ganjam). The district is considered to be one of the potential resources for fish production having 11,580 ha of freshwater, 4023.04 ha of brackish water 4023.04 ha & 60 Km. coast line of marine fisheries. The district has 28 numbers of marine fishing villages and 2nd highest numbers (20) of fish landing centres. Landings are contributed by motorized and traditional boats using gillnet, seine net (shore seine), long line and hook and line. There are 2250 numbers of fisheries Co-operatives working in the district. The district is having 8 numbers of fresh fish market and 2 numbers of dry fish markets. Besides this, there are 3rd highest i.e 6,566 numbers of fishing gears are operated in the district. These resources are very much suitable for marine fish production, pond culture, reservoir fisheries and shrimp culture. It provide an excellent opportunity to develop pisciculture for increasing fish production to meet the growing demand of the people as well as play a significant role for providing employment opportunity to the rural poor.

The district is having higher number of fisherfolk population i.e 37,715 compared to other coastal districts. Besides this, the highest numbers of fisherwomen are involved fisheries related activities in Ganjam district i.e. 13,410. In the district 68% belong to full time category where as 20% and 12% are in part time and occasionally involved. DoF, Ganjam district, Government of Odisha (2020).

Justification for selecting Puri district

Puri district is one of the important districts in marine fish production in Odisha. The district produces 2nd highest in marine fish landing after Jagatsighpur district. The district have the highest stretch of coastal line i.e. 160 kms. among other 6 coastal districts. There are five blocks of marine fishing villages in the district of Puri. This is the leading district in Odisha for having the maximum number of fishing gear i.e (12,220). (such as hooks, lines, drift/gillnets, shore seines, bag nets, small purse- seines and boat seines operation. Naskar (2018) [21]. A total of 7116 numbers of fisheries cooperatives are operating in the district. There are 7 numbers of fresh fish market and 2 numbers of dry fish markets are available.

A total of 63, 829 numbers of fisherfolk population is engaged in fisheries and related activities. Fishermen in Puri district are highest i.e. 82% of fishers belonged to full time category, 11% part time and 7% occasional. Among other coastal districts in Puri fisher women are involved in more diverse activities in addition to fishing like fish packaging, wage labour at processing centres, and selling of marine ornaments at the sea beaches during tourist seasons.

Chakraborty (2016) [22] and DoF, Puri district, Government of Odisha, 2020)

Sampling procedure

Field visits to the markets revealed that there are 2 kinds of fish retailers i.e., fresh and dry fish retailers. Most fish retailers were women. The fresh fish retailers sell fresh fish which are sourced/collected from landing centres and wholesalers. Women wash and clean the fish and then sell it in the market.

Dry fish retailers sell traditionally dried/processed fish products. They collect the fish from landing centres and then add salt to it and dry it under the sun. Then these are sold in market. Some dry fish sellers procure dry fish directly from wholesalers and sell it in local market.

For this study, 60 fresh fish retailers and 60 dry fish retailers were selected from Puri and Ganjam districts as follows.

In Ganjam there are 10 major fish markets and for the current study the information was collected from fish retailers of 7 fish markets i.e., Kamapalli, Karapalli, Lanjipalli, Bijipur, Gopalpur, Rambha and Huma which are of importance with reference to commercial activities. DoF, Ganjam (2020).

In Puri district there 12 major fish markets. Among these, information was collected from fish retailers of Pentokota, Urban Haat, Swargaduar, Office chock fish, Satalahadi fishing centre, station bazar markets and landing centre markets. Department of Fisheries, Puri (2020) [20]

Thus for this study, 60 fresh fish retailers and 60 dry fish retailers were selected from Puri and Ganjam districts and the details are presented in table 1.

Table 1: Sampling plan for fresh and dry fish retailers

Types of Retailer	Puri District		Ganjam District	
	Market	**Number of retailers selected for study**	**Market**	**Number of retailers selected for study**
Fresh Fish	Pentokota	3	Kamapallii	5
	Urban Haat	4	Karapalii	5
	Swargaduar	9	Lanjipalii	5
	CMFRI office chock	3	Bijipur	3
	Satalhadi	3	Gopalpur	7
	Station bazar	5	Rambha	5
	Landing centre	3		
Total fresh fish retailers	30 (Puri) + 30 (Ganjam) = 60			
Dry fish	Pentokota	8	Kamapalli	6
	Urban Haat	5	Lanjipalli	8
	Swargaduar	8	Gopalpur	4
	Satalahadi	5	Rambha	3
	Pentokota	4	Huma	9
Total dry fish	30 (Puri) + 30 (Ganjam) = 60			

An interview schedule was designed to collect information about the profile of fish retailers. Information about profile included age, marital status and level of education. Body weight was measured using a digital weighing scale (Omron HN-289, accuracy ±0.1 kg). Participants were weighed without footwear and with light clothing. Height was recorded by measuring tape. Body Mass Index (BMI) was calculated using the following formula which was compared with the recommended range.

$$BMI = \frac{Weight\ (in\ Kilogram)}{Height^2\ (in\ meter)}$$

Work profile was recorded using an interview schedule.

Mann Whitney U Test was performed to test whether there was any significant difference between age, weight, height and BMI of fresh and dry fish retailers. Mann Whitney U test is denoted by U, and it is defined through U1 and U2 below.

$$U_1 = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1$$

$$U_2 = n_1 n_2 + \frac{n_2(n_2+1)}{2} - R_2$$

Where,

n_1 = sample size of fresh fish retailers and R_1 = sum of the ranks of fresh fish retailers

n_2 =sample size of dry fish retailers and R_2 = sum of the ranks of dry fish retailers

Results and Discussion

Profile of fresh and dry fish retailers

Age

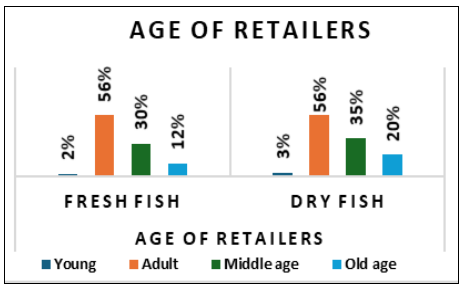

Fig 1: Average of fresh and dry fish retailers

The analysis revealed that the mean age of fresh fish retailers (44 years) and dry fish retailers (43 years) is relatively similar. A significant proportion (56%) of all retailers belong to the adult age group (26-44 years), indicating that this age range is the most actively engaged in fish retailing. The representation from the younger age

group (18-25 years) is minimal, comprising only 2% of fresh fish retailers and 3% of dry fish retailers. Retailers from the middle age group (45-59 years) are present in comparable proportions across both groups. Notably, a higher percentage of dry fish retailers (20%) fall into the older age group (>60 years) compared to fresh fish retailers (12%), suggesting a slightly greater presence of elderly individuals in dry fish retailing.

Work Experience

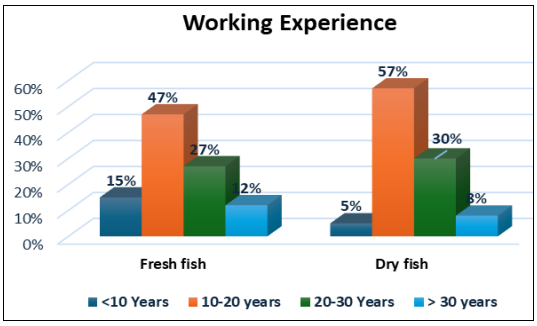

Fig 2: Work experience of fresh and dry fish retailers

The data on working experience indicated that majority of retailers had 10-20 years of experience in fish retailing business, comprising 47% of fresh fish retailers and 57% of dry fish retailers. A considerable proportion of retailers also fall within the 20-30 years experience range, accounting for 27% of fresh fish and 30% of dry fish retailers. Retailers with less than 10 years of experience were fewer, representing 15% of fresh fish and only 5% of dry fish retailers. Notably, those with over 30 years of experience constituted a small fraction, with 12% among fresh fish retailers and just 3% among dry fish retailers.

Education

Majority of both fresh and dry fish retailers possessed primary level education (up to Class 5), accounting for 63% and 57% respectively. Secondary level education (Class 6 to 10) was held by 27% of fresh fish retailers and 30% of dry fish retailers. A smaller proportion of respondents reported having no formal education, comprising 10% of fresh fish retailers and 13% of dry fish retailers. These findings indicate that most fish retailers have basic educational backgrounds, with some lacking formal schooling.

Marital status

The marital status distribution of respondents indicated that the majority of retailers werere married, with 86% of fresh fish retailers and 73% of dry fish retailers falling into this category. Unmarried individuals constituted a small portion, accounting for 6% of fresh fish retailers and 7% of dry fish retailers. Additionally, 11% of fresh fish retailers and 20% of dry fish retailers were widowed, suggesting women headed family households.

Caste

All respondents in the study belonged to traditional fishing communities, specifically identified as *Kaibarta/Nolia* in the local language of Odisha. This uniformity in caste background reflects the community-based nature of fish retailing in the region.

Family type

The analysis of family structure among the respondents revealed that a majority of retailers belonged to nuclear families. Specifically, 85% of fresh fish retailers and 77% of dry fish retailers were from nuclear family setups. In contrast, only 23% of fresh fish retailers and 15% of dry fish retailers belonged to joint families.

Life insurance

There were 56% of fresh and 47% of dry fish retailers having life insurance.

In summary, the profile highlights similarities and minor differences between fresh fish retailers and dry fish retailers in terms of demographic and anthropometric characteristics.

Body weight

Body weight was measured using a digital weighing scale (Omron HN-289, accuracy ±0.1 kg). Participants were weighed without footwear and with light clothing, following standard anthropometric procedures. The result is presented below

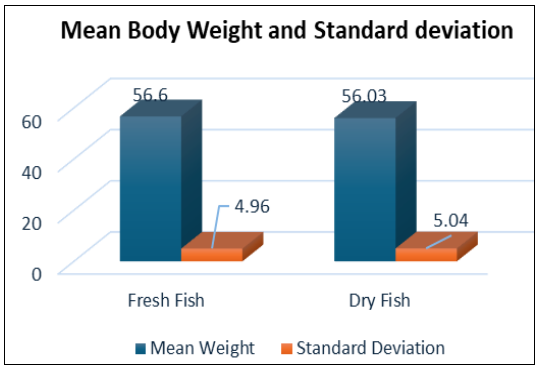

Fig 7: Body weight of fresh and dry fish retailers

The body weight of fish retailers was measured and analyzed to compare differences between fresh fish and dry fish retailers.

From figure 7, it is observed that the mean body weight of fresh fish retailers was 56.6 kg, while that of dry fish retailers was 56.03 kg.

Statistically, there was no difference ($p = 0.52$) in body weight between fresh and dry fish retailers.

Body height

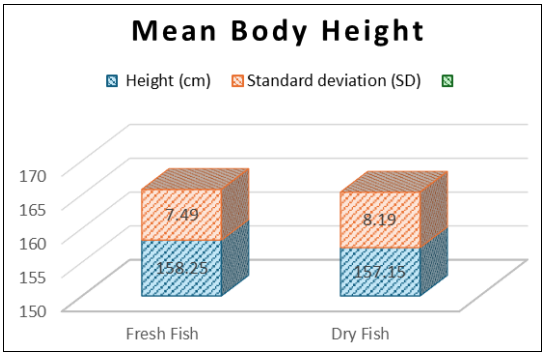

Fig 8: Body height of fresh and dry fish retailers

The mean body height of fresh fish retailers was 158.25 cm while dry fish retailers had a mean height of 157.15 cms. An independent samples t-test was conducted to assess whether the observed difference in average height was statistically significant. The assumptions of normality and equal variances were tested and found to be satisfied. The t-test result was t(118) = 0.78, with a p-value of 0.44. Since the p-value is greater than the commonly accepted significance level of 0.05, the difference in body height between the two groups is not statistically significant.
This indicated that there is no significant difference in average body height between fresh fish and dry fish retailers.

Body Mass Index (BMI)
To analyze the BMI of fresh and dry fish retailers the Body weight and height of both the groups have taken into consideration.

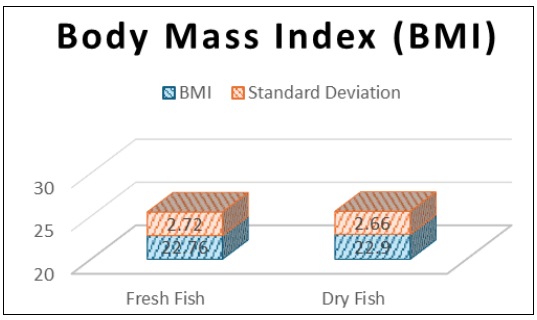

Fig 9: Body Mass Index of fresh and dry fish retailers

The mean BMI of fresh fish retailers was 22.76 ± 2.72, while dry fish retailers had a mean BMI of 22.9 ± 2.66. An independent samples t-test was conducted to evaluate the statistical significance of this difference. The results indicated that the difference in mean BMI between the two groups was not statistically significant, t(118) = -1.54, p = 0.126)
Therefore, the BMI of fresh and dry fish retailers did not differ significantly, suggesting no notable variation in body composition between the groups.
To compare the socio-demographic and physical characteristics of fresh and dry fish retailers, appropriate statistical tests were applied based on the type and distribution of each variable. Categorical variables including education level, marital status, and family type were analyzed using the Chi-Square Test of Independence. The result is presented in the table below.

Table 2: Statistical tests for demographic variables of fresh and dry fish retailers

S. No.	Variables	Asymp. Sig. (2-tailed)
1.	Age	0.106
2.	Weight	0.52
3.	Height	0.44
4.	BMI	0.126
5	Marital status	0.273
6	Educational Level	0.348
7	Family type	0.283

From table 2, it is seen that there were no significant difference between fresh and dry fish retailers in the study population. This implies that both groups have similar workforce characteristics: The absence of significant differences in demographic and anthropometric variables implies that fresh fish retailers and dry fish retailers share similar profiles in terms of age, physical attributes (weight, height, BMI), educational background, and marital status. It also suggests that they come from similar socioeconomic backgrounds and face similar social and economic circumstances. The lack of differences indicates a homogeneous workforce. Similar to this findings Reena and Sharma (2006) [23] also found that there was occupational heterogeneity amongst fisherwomen.

Work profile fresh and dry fish retailers
Fresh fish retailers
The daily work routine of women fresh fish retailers was observed to be demanding, beginning in the early hours of the morning and extending into the evening. Their workday typically starts at 4:00 AM, when they begin their commute to the fish landing centres by walking on foot while carrying an empty bamboo basket on their heads.
Fishing boats generally arrive at the landing centres around 5:00 AM, the women collect and sort the freshly caught fish according to species. Once fishes are sorted, they proceed to the local fish markets, usually reaching by 6:00 AM. Upon arrival, they clean the fish using fresh water and display them neatly on their selling platforms for customers.
Women are engaged in fish retailing activities from 6:00 AM until approximately 12:00 noon. After returning home, they undertake household chores, reflecting the dual burden of income generation and domestic responsibilities. In the evening, they return to the market around 4:00 PM for their second shift, which continues until around 8:00 PM.
Average work duration in the fish market was found to be approximately 8 hours per day, excluding the time spent commuting to and from the landing centres and markets. The work schedule is split between two shifts, indicating a prolonged and segmented working day that contributes significantly to both the family income and fish retailing.

Dry fish retailers
The daily work routine of dry fish retailers was also found to be dual-shift system, balancing both retail and processing activities. The day typically commences at approximately 6:00 AM, when retailers depart for the market on foot, carrying bamboo baskets filled with dry fish on their heads. Upon reaching the market, they engage in retailing activities from 8:00 AM to 11:00 AM, during which they sell various types of dried fish to local consumers.
Following the morning sales period, the retailers return home to perform household responsibilities, including meal preparation and other domestic tasks. By 2:00 PM, they proceed to the fish landing centres to collect low-value fish that are designated for drying. This stage involves participation in post-harvest processing activities, including sorting, cleaning, salting, and drying of fish, which typically lasts for around 2 hours.
After completing the fish drying tasks, they return to the market by approximately 4:00 PM to commence the second shift of retailing, which continues until around 8:00 PM.
On n average, dry fish retailers reported working 8 hours per day, excluding the time spent on commuting. The work

schedule is divided into two distinct shifts, reflecting the dual nature of their occupational engagement retailing and fish processing.

Activities of fresh and dry fish retailers

Fresh and dry fish retailers primarily engage in several key activities to facilitate their retial businesses. These activities are common to both fresh and dry fish retailers and include:

(a) Procuring fish from landing centres: Retailers acquire their stock by sourcing fish from landing centres, where freshly caught fish are brought in by fishing boats.

(b) Arriving at the market with purchased fish to sell: After procuring their stock, retailers transport the fish to local markets where they set up their stalls or platforms for selling.

(c) Sorting: Upon reaching the market, retailers categorize and organize the fish based on species, size, and quality to prepare them for display and sale.

(d) Cleaning: Retailers clean the fish, removing scales, guts, and any impurities to ensure they are fresh and presentable to customers.

(e) Selling: The primary task involves actively engaging with customers, showcasing the fish, and completing sales transactions throughout the day.

For dry fish retailers, additional tasks were:

(f) Drying fish under high temperature: In addition to the above activities, dry fish retailers also engage in drying fresh fish using high-temperature methods to preserve them for extended shelf life.

These activities collectively form the core operations of both fresh and dry fish retail businesses.

Similar activities have been documented in various studies. Sharma (2015) [24] reported that fisherwomen in India engage in fish collection, drying, grading, and selling. Sandaruwan *et al*. (2016) [25] found in Sri Lanka that 98% of fisherwomen spend nearly 19 hours per day in productive activities to support their families. Hemant and Girish (2014) [26] conducted a study in Gujarat, revealing that cooking, cleaning, water fetching, and milk/ghee making were daily tasks for fisherwomen, with cooking taking the most time. Similar findings were reported by Lalmuansangi *et al*. (2022) [28] in Manipur and Mushkam *et al*. (2022) [27] in Telangana, India, emphasizing the substantial time fisherwomen dedicate to productive and reproductive tasks in the fisheries sector using the Gender Analysis Tool for Fisheries and Aquaculture (GATFA) developed by Sharma (2022) [29]. Katre et. al (2024) [30] also highlighted the role of women in reservoir fisheries and Yadav and Sharma (2022) [31] highlighted the role of women in ornamental fish production units in Maharashtra.

Conclusions

The present study comprehensively examined the occupational profiles, socio-economic conditions, and anthropometric status of fresh and dry fish retailers in the coastal districts of Ganjam and Puri, Odisha. The findings revealed that both groups of retailers are predominantly women from traditional fishing communities who actively contribute to the local fish economy through structured daily routines involving long hours of physical labour, especially in tasks like commuting, fish cleaning, sorting, and vending. Socio-economic analysis indicated that most retailers were married, belonged to nuclear families, and had some level of formal education. Anthropometric data indicated that the average height, weight, and BMI of both fresh and dry fish retailers fell within normal ranges and showed no statistically significant differences. The occupational roles and workload were similar in both groups, though dry fish retailers engaged additionally in fish processing, further increasing their burden. Despite the physical intensity and time demands of their work, these women continue to operate within informal structures.

This study infers that both fresh and dry fish retailers in Odisha, despite minor occupational variations, share similar socio-economic and physical characteristics. Their roles are crucial and the lack of significant differences in anthropometric measures suggests comparable health outcomes. The study establishes that fisher women, are the backbone of the local fisheries retail economy.

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