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Assessing fish consumption and its determinants across Andhra Pradesh, India

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Original Article

Abstract

The current paper endeavours to evaluate the spatial pattern of fish utilization and its attributes in Andhra Pradesh. The study was directed over the two distinctive regions *viz.,* urban coastal (Visakhapatnam), rural coastal (Vizianagaram), and non-coastal urban (Kurnool) and non-coastal rural (Anantapur) districts. A total of 1440 fish consumption households was assessed for the study. The consumption profile revealed that 88 per cent of the respondents belong to the middle age group (20-50 years) with higher secondary education (29 per cent). More than 60 per cent devour fish consistently. The outcome revealed that fish consumption over the years improved by virtue of better fish accessibility, availability, and affordability. The fish accessibility was found to be within 1-2 km, as believed by 56 per cent of the buyers. The consumption traits indicated that seer fish was the most favoured species, followed by pomfrets and shrimps. The constraints in fish consumption as perceived by the buyer's included the absence of fresh and preferred fish, exorbitant price, wide fluctuations in price, unpredictable supply and absence/ lack of hygiene in marketing infrastructure. Various statistical and econometric tools included conjoint analysis, preference assessment index, and discriminant analysis were utilized for analyzing the information.

Keywords*: Consumption, preferred species, discriminant analysis*

Introduction

The fisheries sector assumes a significant role in the development of the national economy, reflecting a noteworthy development statistics when compared to other food producing sectors in the nation. Fish is accepted as a significant constituent of every household in their daily consumption routine. On one side, fish continues to be a poor man's protein guaranteeing food security, and on opposite side it offers a delicacy across regions on account of it taste and preference. It has been distinguished that around 60 per cent of the Indian people expend fish and consumption patterns vary spatio-temporally over the distinctive social textures (Shyam, 2013a). The consumption pattern demonstrated that in the urban area fish consumption is more than the rural areas.

Fish has been perceived as an important food source for people for quite a long time and is favoured as an ideal eating option (Shyam, 2013b). In contrast to the other sources of dietary animal proteins, consumers have wide choice for fish as far as affordability is concerned. There are many varieties and species of fishes available, particularly in the tropical nations (FAO, 2013). Fish has consistently been viewed as a food essential for healthy wellbeing (Shyam, 2016).On a fresh-weight basis, fish contains a good quantity of protein, about 18-20 per cent,

and contains all the essential amino acids (Mohanty, 2011). This would ensure that the fisheries sector to contribute in achieving 'Millennium Development Goals (MDGs: Goal 4- Reducing child mortality; Goal 5- Improved maternal health) since high malnutrition levels are associated with increased child mortality rates.

Andhra Pradesh is one of the significant fish producing and consuming states in the nation where the per capita utilization of fish is more than the national average. The demand and supply relations are on par throughout the long term and are regularly supported by the doctrines of fish accessibility, availability and affordability. The supply-side is catered by the varied fisheries resources including marine and inland resources. The demand continues to surge high because of the differed fish utilisation habits, income and export (Rao *et al.,* 2008).

The fish availability within the state ensures that the fish quality isn't hampered by significant distance travel. The accessibility within the close proximity ensures that the customers needn't venture out long to buy fish and is accessible nearby. The affordability factors survey the acknowledgment of cost across species, size, period, item structure, strategy for fish catch and season.

Thus, the current study examines the culturally diverse attributes towards fish consumption across households from the coastal and non-coastal regions of Andhra Pradesh. There is an absence of detailed data on fish consumption patterns and varieties of fish consumed in households. The findings of the research study would aim at developing data base and also on suggesting policy inputs for augmented fish consumption.

Objectives

The overall objectives of the proposed study are to investigate the fish consumption patterns over the four selected study zones, highlighting:

Analysing the trends and pattern of fish consumption.

Identifying the major demand drivers of fish consumption.

Assessing the major constraints in fish consumption.

Material and methods

The study was conducted by using primary data gathered from households across four districts of Andhra Pradesh covering coastal, on-coastal and urban and rural locales. Accordingly, 1440 consumer households from urban coastal (Visakhapatnam), rural coastal (Vizianagaram), non-coastal urban (Kurnool) and non-coastal rural (Anantapur) districts were considered utilizing with a pre-tested schedule. Purposive random sampling method was used for choosing the respondents. (Fig. 1)

The pre-tested schedule comprises of individual profile, income and expenditure pattern, fish consumption pattern, major favoured species, significant buying source, the elements which drive individuals to expend on fish. Tools such as percentage analysis, garrett ranking, conjoint analysis, discriminant analysis and preference assessment index techniques were used to find out the consumer inclinations and pattern of fish consumption among the respondents.

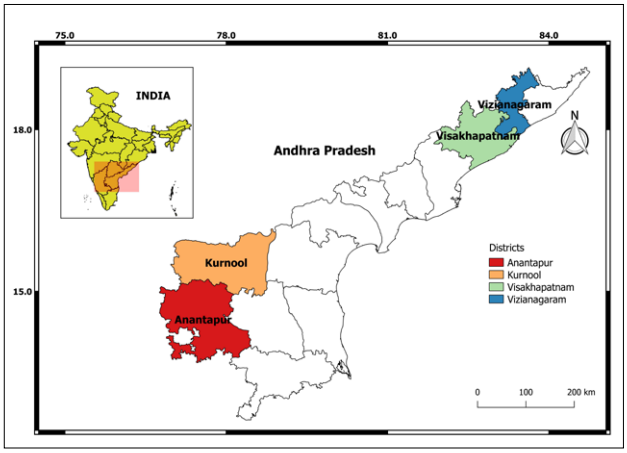

Fig. 1. Locale of the study

Analytical Tools

Descriptions of the tools used for the study are given as under:

Conjoint Analysis

Conjoint analysis is defined as the method in which a consumer or a decision-maker evaluates and estimates a confined number of alternatives systematically. The analysis is applied for the fields of food product choice, marketing, consumer preferences on market segments, consumers' willingness to pay for different product and quality attributes (Vriens *et al.,* 1998; Wirth *et al*., 1991).

Two different calculation methods are used in the conjoint analysis in order to determine the significance levels of the product characteristics. First of them is the determination of the differences between partial utility values (part-worth values) of every feature. In partial utility model, every feature level of the product is free from each other and regarding feature level partial benefits constitute the total utility of the consumer. General consumer evaluation on the product or service and thus, contribution of every characteristic to his preference is determined by partial utility (part-worth). Part-worth contribution

model (additive part-worth), which is used widespread in the conjoint analysis can be explained as follows:

$Pref_{ijkl} = a_i + b_j + c_k + d_l$

Where,

$Pref_{ijk}$ = Consumer preference or total utility

a_i = Product A feature part-worth in level i

b_j = Product B feature part-worth in level j

c_k = Product C feature part-worth in level k

d_l = Product D feature part-worth in level l is expressed so

In this study, the full concept method was chosen for the collection of data that is evaluated in the conjoint analysis. Accordingly, question cards are prepared for every feature level and are provided to consumers, which include features that are determined regarding the product and level of every feature. Thus, the degree of participation of consumers to every alternative and the level of perception for each alternative are determined.

Preference Assessment Index (PAI)

The preference assessment index approach was utilized here to assess main impetuses that impact buyer preference which leads to an expansion in the interest for different kinds of fishes (Shyam *et al.,* 2019). The preference assessment index approach computes preference indices utilizing aggregate data for a set of indicators. An indicator represents a characteristic or a parameter of a system, and it is a pragmatic, observable measure of a concept. Utilizing the arrangement of indicators portrayed in tables, we quantitatively evaluated the preference index based on the systems utilizing individual indicators. Since each indicator was estimated on an alternate scale, they were standardized (rescaled from 0 to 1) by utilizing the following equations

$$x_{ij} = \frac{X_{ij} - \min_i \{X_{ij}\}}{\max_i \{X_{ij}\} - \min_i \{X_{ij}\}}$$; if x_{ij} increases with preference ..(1)

$$y_{ij} = \frac{\max_i \{X_{ij}\} - X_{ij}}{\max_i \{X_{ij}\} - \min_i \{X_{ij}\}}$$; if y_{ij} decreases with preference ..(2)

Where, x_{ij} and y_{ij} are the variables representing effects on the preference indices. The values after normalisation were changed into a four point Likert scale, sorted as 0-0.25, 0.26-0.5, 0.6-0.75 and 0.76-1 which are assigned score values 1 (low), 2 (moderate), 3 (high) and 4 (very high) respectively. The mean estimations of the various species as well as the different parameters of preference were calculated and were combined to develop a preference index.

Discriminant Analysis

Discriminant analysis (DA) involves the determination of a linear equation like regression that will predict which group the case belongs to. It is shown as follows:

$D = v_1x_1 + v_2x_2 + v_3x_3 + \ldots\ldots\ldots v_ix_i + a$

D= discriminant function, V= the discriminant coefficient of weight for that variable, X= respondent's score for that variable, a = constant, i= the number of predictor variables.

Results and discussion

The data was collected, analyzed and the outcomes are discussed under the following heads:

Demographic profile

Respondent socio-demographic data incorporates sex, age and educational qualification. Table 1 shows the gender details of the respondents. Overall, the majority of the respondents are male (76.18 per cent) rest of them are female (23.82 per cent). Non-coastal, rural area has majority of female respondents (55 per cent) than male (45 per cent).While in coastal areas have more than 98 per cent male respondents for the study.

Table 1. Gender details of the selected respondents in Andhra Pradesh

Gender	Coastal Rural	Non Coastal Urban	Non Coastal Rural	Coastal Urban	Total
Male	356(98.88)	226(62.78)	162(45.02)	353(98.06)	1097(76.18)
Female	4 (1.12)	134(37.22)	198(54.98)	7(1.94)	343(23.82)
Total	360(100)	360(100)	360(100)	360(100)	1440(100)

Note: Figures in parenthesis indicate percent to total

Table 2. Age of the selected respondents in Andhra Pradesh

Age (years)	Coastal Rural	Non Coastal Urban	Non Coastal Rural	Coastal Urban	Total
20-29	312(86.67)	128(35.60)	98(27.28)	13(3.6)	551(38.27)
30-39	22(6.11)	94(26.21)	121(33.51)	139(38.6)	376(26.11)
40-49	15(4.17)	83(22.98)	77(21.43)	165(45.9)	340(23.61)
>50	11(3.06)	55(15.21)	64(17.78)	43(11.9)	173(12.01)
Total	360(100)	360(100)	360(100)	360(100)	1440(100.00)

Note: Figures in parenthesis indicate percent to total

Table 3. Education details of the selected respondents in Andhra Pradesh

Education level	Coastal Rural	Non Coastal Urban	Non Coastal Rural	Coastal Urban	Total
Illiterate	95(26.39)	78(21.54)	73(20.35)	8(2.22)	254(17.64)
Primary	13(3.61)	25(6.91)	83(23.10)	26(7.22)	147(10.21)
High School	8(2.22)	56(15.45)	38(10.62)	59(16.39)	161(11.18)
Higher Secondary	229(63.61)	32(8.94)	48(13.27)	111(30.83)	420(29.17)
Degree	15(4.17)	29(8.13)	45(12.39)	141(39.17)	230(15.97)
Professional	0	140(39.02)	73(20.27)	15(4.17)	228(15.83)
Total	360(100)	360 (100)	360(100)	360(100)	1440(100)

Note: Figures in parenthesis indicate percent to total

Age Profile

The age profile of the respondents shown in Table 2 points out that 38.27 per cent of the respondents belongs to 20-29 age group, 49.72 per cent of the respondents belongs to 30-49 years age group while the rest 12.01 per cent of them are the over 50 years age group.

Educational status

Overall, the educational status of the respondents mentioned in Table 3 shows that 29.17 per cent of them had education up to higher secondary. 15.97 per cent of the respondents having degree level education and 15.83 per cent having professional level education. Among the respondents just 11.18 per cent had possessed high school education and 10.21 per cent are had possessed primary level of education. The level of education level was high as demonstrated by a low level of illiterates (17.64 per cent) in the sample.

Household Expenditure Pattern

The average monthly expenditure of the respondents across the regions were examined (Fig. 2) and it shows that coastal urban (₹21,477) has the more normal monthly household expenditure followed by non-coastal urban (₹15,872), non-coastal rural (₹14,429) and coastal rural (₹10,449).

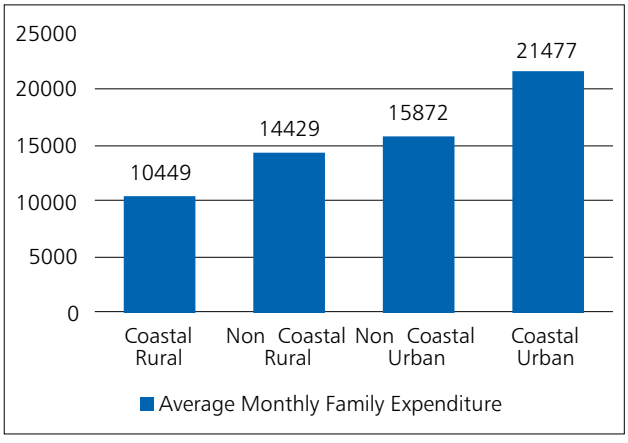

Fig. 2. Average monthly family expenditure in different regions of Andhra Pradesh

In coastal rural households average monthly household expenditure on food is ₹5,449 and it ranges from ₹2,080 to ₹7,200. The mean monthly mean consumption expenditure on fish is ₹1,614 ranging from ₹400 to ₹2,000. In the non-coastal rural region the respondents spend 42 per cent of their income on food. In non-coastal urban the respondents expenditure on food was ₹7,361 (46.38 per cent), followed by shelter (14.08 per cent), education (9.44 per cent), garments (8.38 per cent), medical care (7.36 per cent),social expenses (5.10 per cent) and fuel/power (5.02 per cent), and in coastal urban the mean expenditure consumption is high on food (37.77 per cent) followed by shelter (17.01 per cent), education (15.07 per cent), garments (7.78 per cent), medical care (6.97 per cent),social expenses (6.25 per cent) and others (4.09 per cent).

Fish consumption profile

Frequency of consumption

The frequency of fish consumption over the selected areas was investigated and the outcomes are shown in (Table 4). 21.74 per cent of the respondents consume fish weekly, followed by 21.18 per cent fish daily and monthly, 20.42 per cent twice in a week and 7.57 per cent consume occasionally. The assessment of fish consumption across different locales indicated that coastal rural (74.86 per cent) and non-coastal urban (43.18 per cent) consume daily and non-coastal rural consume twice in seven days (30.81 per cent), and coastal urban expend monthly (44.71 per cent).

Quantity of fish consumption

The annual per capita fish consumption over the study locales was

Table 4. Frequency of fish consumption in the selected regions of Andhra Pradesh

Frequency	Coastal Rural	Non Coastal Urban	Non Coastal Rural	Coastal Urban	Total
Daily	269(74.86)	4(1.13)	12(3.32)	20(5.56)	305(21.18)
Alternatively	4(1.14)	22(6.01)	27(7.58)	23(6.39)	76(5.28)
Twice in a week	22(6.00)	155(43.18)	111(30.81)	6(1.67)	294(20.42)
Weekly	5(1.43)	146(40.59)	107(29.86)	55(15.28)	313(21.73)
Fortnightly	10(2.86)	7(1.95)	19(5.21)	2(0.56)	38(2.64)
Seasonal	2(0.57)	5(1.30)	9(2.37)	93(25.83)	109(7.57)
Monthly	48(13.14)	21(5.84)	75(20.85)	161(44.71)	305(21.18)
Total	360(100)	360(100)	360(100)	360(100)	1440 (100)

Note: Figures in parenthesis indicate percent to total

Table 5. Average monthly family fish consumption in the selected regions of Andhra Pradesh (Kg)

Monthly	Coastal Rural	Non Coastal Urban	Non Coastal Rural	Coastal Urban	Total
< 1 kg	32(8.89)	67(18.71)	26(7.14)	18(5.00)	143(9.93)
1-2 kg	125(34.72)	49(13.55)	57(15.71)	180(50.00)	411(28.54)
2-3 kg	189(52.50)	196(54.19)	226(62.86)	132(36.67)	743(51.60)
3-5 kg	14(3.89)	46(12.90)	51(14.29)	30(8.33)	141(9.80)
>5 kg	0	2(0.65)	0	0	2(0.13)
Total	360(100)	360(100)	360(100)	360(100)	1440(100.0)

Note: Figures in parenthesis indicate percent to total

Table 6. Average species composition in the monthly per capita fish consumption basket (in Kg).

Species	Coastal Rural	Non Coastal Urban	Non Coastal Rural	Coastal Urban	Total
Anchovies	0.040	0.063	0.028	0.075	0.053
Barracuda	0.125	0.000	0.000	0.008	0.033
Bombay duck	0.008	0.038	0.038	0.025	0.028
Carps	0.000	0.000	0.000	0.008	0.003
Cat fish	0.000	0.000	0.000	0.025	0.008
Cephalopods	0.025	0.008	0.008	0.015	0.015
Flat fish	0.008	0.000	0.000	0.008	0.005
Hilsa	0.045	0.030	0.030	0.050	0.040
Mackerel	0.050	0.013	0.018	0.083	0.040
Pomfrets	0.050	0.013	0.013	0.100	0.045
Rays	0.050	0.030	0.030	0.050	0.040
Red snapper	0.005	0.000	0.000	0.025	0.008
Ribbon fishes	0.000	0.030	0.083	0.065	0.045
Sardine	0.050	0.028	0.028	0.075	0.045
Seer fish	0.050	0.153	0.153	0.095	0.113
Shark	0.050	0.040	0.040	0.050	0.045
Shrimps	0.060	0.043	0.005	0.075	0.045
Threadfin breams	0.075	0.000	0.000	0.025	0.025
Tuna	0.093	0.040	0.013	0.050	0.050
Others	0.010	0.138	0.000	0.010	0.040
Total	0.793	0.663	0.483	0.915	0.713

found to be 8.56 kg ranging from 5.80 in the case of rural non-coastal to 10.98 kg in the case of urban coastal region. The yearly per capita consumption in the coastal rural and non-coastal urban was found to be 9.52kg and 7.96 kg respectively. The quantity of fish consumption and normal species composition as reported by the respondents were clearly indicated in Table 5 and 6.

The species composition in the monthly per capita fish utilization was investigated. Among the species seer fish (0.113 kg) is the most preferred fish chosen in the selected areas of study. Looking at the different study areas, non-coastal areas were the most noteworthy (0.153 kg) than coastal areas. Being the non-coastal area, the availability and the consumer preference of seer fish in Andhra Pradesh remarked as the major reasons for the highest utilization rate.

Access to buying fish

The results of access to buying fish (Table 7) demonstrates that 46.94 per cent of the respondents travel between 1-2 km, 32.64 per cent travel 2-5 km to purchase fish. Contrastingly the different selected areas of study coastal rural (71.94 per cent), coastal urban (58.06 per cent) and non-coastal urban (41.9 per cent) travel 1-2 km to purchase fish though non-coastal rural (62.86 per cent) travel 2-5 km to purchase fish. The outcomes uncover that a larger part of the respondents were in close proximity to fish purchasing sources.

Source of purchase

Source of purchase was reported varied across consumers (Table 8). Among the respondents, 48. 17 per cent opined that retail market as the source of fish purchase followed by landing/ production center (18.50 per cent). The area wise source of fish purchase was different. Retail market was the major source of purchase in non-coastal rural (71 per cent), non-coastal urban (61 per cent), and coastal urban (33.89 per cent) area. Coastal rural (50.28 per cent) has landing center / production center as the significant source of purchase.

Major drivers in buying fish - Conjoint Analysis

To find the consumer preference, conjoint analysis was done with 3 factors of 24 distinctive factor levels giving 3^{24} different combinations. Utilizing the partial factorial design, the combinations were enormously diminished to 25 which give off an impression of being sensible for further analysis. The fish quality set formed for the conjoint analysis is given in the following Table 9.

Table 7. Distance travelled to purchase fish in Andhra Pradesh

Distance	Coastal Rural	Non Coastal Urban	Non Coastal Rural	Coastal Urban	Total
< 1 Km	1(0.28)	92(25.6)	26(7.14)	4(1.11)	123(8.54)
1 to 2 km	259(71.94)	151(41.9)	57(15.71)	209(58.06)	676(46.94)
2 to 5 km	4(1.11)	112(31.1)	226(62.86)	128(35.56)	470(32.64)
> 5 km	96(26.67)	5(1.4)	51(14.29)	19(5.28)	171(11.88)
Total	360 (100)	360(100)	360(100)	360(100)	1440(100)

Note: Figures in parenthesis indicate per cent to total

Table 8. Source of fish purchase in Andhra Pradesh

Source of purchase	Coastal Rural	Non Coastal Urban	Non Coastal Rural	Coastal Urban	Total
Landing / Production centre	181(50.28)	6(2)	2(1)	77(21.39)	266(18.50)
Retail market	94(26.11)	220(61)	258(71)	122(33.89)	694(48.17)
Fish vendors at door step	60(16.67)	40(11)	14(4)	118(32.78)	232(16.11)
Wholesale market	0	29(8)	43(12)	29(8.06)	101(7.01)
Online	0	22(6)	0	0	22(1.53)
Super market	0	14(4)	7(2)	0	21(1.46)
Way side market	25(6.94)	29(8)	36(10)	14(3.88)	104(7.22)
Total	360(100)	360(100)	360(100)	360(100)	1440(100)

Note: Figures in parenthesis indicate percent to total

Table 9. Drivers of buying fish in Andhra Pradesh

Factor	Factor Levels
Drivers for buying fish	Price/ Affordability, Quality, Nutrition, Species, Taste and preference, Substitute to meat, Persuasion, Tradition, Availability, Accessibility
Sources of Purchase	Landing Centre, Retail Market, Wholesale Market, Online, Fish vendors at door step, Supermarkets, Way side Market
Reasons for source of purchase	Distance, Freshness, Variety of species, Credit, Cheap, Trust , Time

In the study, the conformity of the model was estimated under the conjoint analysis with the actual consumer preferences were evaluated as 0.998 according to the Pearson R. and 0.885 according to the Kendall's Tau. These measurements show the connection between the applied model and the observed results. At the point when the results of the analysis were deciphered, it was found out that the factor levels responsible for drivers for purchasing fish is the most significant factor in the assurance of the consumer decision in fish consumption. The effect of drivers for buying fish (DBF) on buying choice was about 36.43 per cent. Sources of purchasing fish (SOP) is the second most significant factor followed by the drivers for purchasing fish of about 33.57 per cent significance. The third factor influencing consumption pattern is the reason for the source of purchase place (RSP). Place of purchase influences the consumer decision about 30 per cent was found. The results of the conjoint analysis are indicated in Table 10.

Part-worth or marginal utility value of each factor level shows the impact of the concerning level on buyer preferences. The factor level, which has the highest score of part-worth, is the most ideal option by consumers. The drivers for purchasing fish which is the highest factor have the highest score part worth incentive for quality (0.56) trailed by the tradition (0.55). The taste and preferences have a part worth estimation of about 0.52 where as an alternative for meat records 0.51 utility worth. Availability holds 0.41 parts worth score followed by variety of species of about 0.40 parts worth. Nutrition and price/affordability are the least effected in purchasing fish with part worth values about 0.23 and 0.11 respectively. Hence, the majority of the buyers purchase fish based on the quality of fish and tradition followed for purchasing fish.

In the sources of buying fish, which is the second most important factor in consumption preference, have the highest part-worth score for the retail market (0.56) followed by the fish vendors at the door step (0.43). The buyers wanted to purchase fish from the whole sale market have a part worth score of about 0.33 and that of landing centre have a score of about 0.16. Supermarkets hold for about 0.11 parts worth whereas online administrations have just 0.005 parts worth score in the consumer preferences for the sources of purchasing fish. The results of the analysis indicates that majority of the consumer prefer retail markets for purchasing fish regardless of different sources. The quality, good taste and substitute to meat can be recognized

Table 10. Conjoint analysis results

Factors	Part worth value	Significance level (%)
Drivers for buying fish (DBF)		
Price/ Affordability	0.11	36.43
Quality	0.56	
Nutrition	0.23	
Species	0.40	
Taste and preference	0.52	
Substitute to meat	0.51	
Persuasion	0.33	
Tradition	0.55	
Availability	0.41	
Accessibility	0.30	
Sources of purchasing fish (SOP)		
Landing Centre	0.16	33.57
Retail Market	0.56	
Wholesale Market	0.33	
Online	0.005	
Fish vendors at door step	0.43	
Supermarkets	0.11	
Wayside Market	0.30	
Reasons for source of purchase place (RSP)		
Distance	0.43	30.00
Freshness	0.45	
Variety of species	0.25	
Credit	0.20	
Cheap	0.30	
Trust	0.22	
Time	0.13	
Total worth constant	4.24	100.00
Total (%)	Significance = 0.0000	
Pearson's R = 0.998	Significance = 0.0009	
Kendall's Tau =0.833		

as the compelling components in the consumers' decision in the inclination of the buying fish. The outcomes of the analysis demonstrates that fish sellers at doorstep, whole sale markets and road side markets etc., have extensive significance in choosing the market by the consumers for fish purchase.

The third and the last significant factor in consumer preferences, the explanations behind picking the spot of procurement has got freshness of the available fish in the market place has got the first place with the highest part worth value about 0.45. The convenience to the market place is the

second most with part score of 0.43.The substitute to meat and variety of species holds the place in consumer preference with part worth scores of about 0.30 and 0.25 respectively. The trusts among the fish merchants and purchasers have 0.22 part worth score in the consumer preferences while credit accounts about 0.20 of the part worth score. Among the reasons, time has the least part worth score of about 0.13 which shows that time has no relevance in the reasons of purchasing fish.

Average and total utility or worth values of the combinations, which were designed in the scope of the conjoint analysis and total worth value is composed of a sum of factor level scores. The factor and factor level having the highest total utility is preferred by consumers with priority. The combination, which has the lowest total utility value, is the product set that consumers prefer least. And from these, the overall results interpret that the optimum fish quality set, which provides the consumers with optimum benefit, is the variety of fish from the fish markets which are highly nutritious, good quality and taste. The optimum fish quality set is represented in the Table 11.

Table 11. Optimum fish quality set

Drivers of buying fish	Quality	Total Worth Utility
Source of purchase	Retail Market	1.521
Reasons for the place of purchase	Freshness	

Preferred species and major drivers in fish consumption

The preference index is the composite index that considers various factors that decide fish consumption like availability, accessibility, quality, nutrition, tradition, and so on. The preference index for the variety of fish reported by the respondents is given in the following Table 12.

The outcomes demonstrate that among the various species, Seer fish and Pomfrets remains the most favored fish with the

Table 12. Preference index of major fish species in Andhra Pradesh

Species	Parameters									Preference Index
	Availability	Accessibility	Quality	Nutrition	Taste & Preference	Tradition	Meat Substitute	Persuasion	Price	
Seer fish	0.64	0.75	0.43	0.61	0.52	0.59	0.39	0.36	0.56	0.54
Pomfrets	0.64	0.68	0.52	0.71	0.65	0.59	0.47	0.32	0.29	0.54
Shrimps	0.69	0.57	0.54	0.65	0.60	0.62	0.38	0.26	0.44	0.53
Mackerels	0.58	0.63	0.65	0.72	0.65	0.45	0.47	0.19	0.34	0.51
Anchovies	0.71	0.63	0.55	0.56	0.51	0.51	0.35	0.38	0.42	0.51
Tuna	0.59	0.70	0.64	0.60	0.56	0.38	0.39	0.30	0.38	0.50
Red snapper	0.49	0.54	0.71	0.56	0.64	0.36	0.61	0.35	0.25	0.50
Barracuda	0.62	0.50	0.53	0.38	0.38	0.41	0.34	0.56	0.66	0.49
Sardine	0.60	0.67	0.68	0.63	0.37	0.49	0.28	0.15	0.56	0.49
Hilsa	0.59	0.62	0.67	0.52	0.58	0.43	0.45	0.20	0.32	0.49
Prawns	0.58	0.60	0.35	0.46	0.51	0.41	0.33	0.52	0.52	0.48
Carps	0.46	0.56	0.57	0.48	0.43	0.37	0.49	0.40	0.56	0.48
Cephalopods	0.48	0.64	0.64	0.59	0.47	0.43	0.41	0.19	0.50	0.48
Shark	0.42	0.54	0.60	0.52	0.59	0.39	0.56	0.35	0.35	0.48
Rays	0.40	0.51	0.76	0.45	0.52	0.28	0.49	0.47	0.48	0.48
Bombay duck	0.54	0.56	0.53	0.43	0.44	0.38	0.47	0.32	0.63	0.48
Threadfin breams	0.50	0.53	0.44	0.55	0.56	0.39	0.44	0.32	0.48	0.47
Ribbon fish	0.54	0.43	0.62	0.39	0.46	0.51	0.49	0.29	0.45	0.46
Flatfish	0.64	0.57	0.58	0.49	0.29	0.33	0.23	0.42	0.65	0.46
Catla	0.59	0.64	0.70	0.44	0.42	0.35	0.41	0.36	0.16	0.45
Catfish	0.51	0.46	0.61	0.52	0.41	0.27	0.30	0.38	0.57	0.44
Others	0.51	0.39	0.58	0.52	0.39	0.28	0.33	0.40	0.42	0.42

highest index of 0.54 followed by Shrimps (0.53), Mackerels and Anchovies (0.51), Tuna and Red snapper (0.50), Barracuda, Sardines and Hilsa (0.49), Prawns, Carps, Cephalopods, Bombay duck, Sharks and Rays (0.48), Threadfinbreams (0.47), Ribbon fish and Flat fish (0.46), Catla (0.45) and Cat fish (0.41).

Driving forces of fish consumption- Discriminant Analysis

Driving forces that impact buyer preferences leads to an expansion in demand for different types of which can be determined by investigating the consumer satisfaction and preferences, having a diverse background. The Discriminant Analysis approach is utilized herewith for assessing the decisions of the respondents for the consumption, and the study recognizes the various drivers for the fish consumption (Table 13).

Wilks's Lambda statistic was utilized to test the significance of the function. The estimation of Wilks's lambda 0.147 which changes to a chi-square of 18.307 with 9 degrees of freedom ($p < 0.001$), brings up that the model is critical and clarifies the consumer preferences for the consumption of fish.

Table 13. Discriminant Analysis Results

Parameters	Wilk's lambda	Significance
Availability	0.873	0.001
Accessibility	0.732	0.000
Quality	0.918	0.033
Nutrition	0.907	0.025
Taste and preference	0.625	0.000
Tradition	0.335	0.000
Meat substitute	0.244	0.000
Persuasion	0.455	0.000
Price	0.534	0.000
Others	0.211	0.000
	Structural Matrix (Canonical loadings)	Unstandardized canonical discriminant function coefficient
Availability	0.533	2.32
Accessibility	0.458	1.32
Quality	0.814	0.88
Nutrition	0.678	0.63
Taste and preference	0.454	0.25
Tradition	-0.200	0.35
Meat substitute	-0.169	0.11
Persuasion	0.255	0.89
Price	0.380	1.00
Others	-0.124	-0.10
Constant		-3.63
Canonical correlation 0.88, Wilks lambda (λ) 0.147, Chi square (9 df) 18.307 $p < 0.000$.		

The discriminant analysis results indicates that quality is the most noteworthy discriminant factor with highest Wilks' Lambda of 0.918 and highest canonical loading (0.814 or 81.4 per cent) towards fish consumption preferences followed by nutrition (0.678 or 67.8 per cent),availability (0.533 or 53.3 per cent), accessibility (0.458 or 45.8 per cent), taste and inclination (0.454 or 45.4 per cent), price (0.38 or 38 per cent),influence (0.255 or 25.5 per cent), others (-0.124 or -12.4 per cent),meat substitute (-0.169 or -16.9 per cent) and tradition (-0.20 or -20 per cent). The factors price and influence accounts just lowest effect among the respondents in fish consumption. Likewise, the least preference has been given for influence and moreover the study analyzed that most of the respondents don't consume fish as a substitute to meat. The various reasons for fish consumption are obviously indicated as discriminant factors in Table 13.

Constraints in fish consumption

The Garrett ranking scores for the limitations in fish consumption are mentioned in Table 14. The significant limitation in the consumption of fish was found to be the unavailability of favored fishes in the state while absence of fresh fish is the second important constraint in the study regions. The respondents opined that purchase and demand of the fish have not been yet reduced due to these reasons and their fish consumption has only increased fairly in despite of the high prices. Yet, the irregular supply, as well as the poor access and different reasons, have also affected in the consumption pattern of the consumers. Due to which they have to rely upon the different hots pots for the utilization of fish.

The study identified that the fish consumption base in Andhra Pradesh is expanding over the years. The consumption analysis shows that yearly per capita fish consumption over the study areas was found to be 8.56 kg ranging from 5.80 kg in rural non-coastal to 10.98 kg in urban coastal regions. The yearly per capita consumption in the coastal rural and non-coastal urban was found to be 9.52 and 7.96 kg, respectively. The study revealed that irrespective of the increased price of fish, the fish consumption rate improved along positively. The study suggested that retail markets are the pivotal point of fish purchase followed by landing / production centre. The consumption preference indicated that seer fish was the most favoured species followed by pomfrets and shrimps. The main constraint in the consumption of fish was observed to be the lack of preferred and fresh fish, irregular supply, wide

Table 14. Constraints in increasing fish consumption

	Coastal Rural		Non Coastal Urban		Non Coastal Rural		Coastal Urban		Total	
Attributes	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Irregular supply	43	IV	19.81	X	85.01	I	48	IV	48.96	III
Lack of fresh fish	40	V	43.28	VII	72.32	II	42	V	49.40	II
Wide fluctuations in price	44	III	45.69	VI	40.10	V	49	III	44.70	IV
High price	55	I	22.58	IX	27.90	VIII	50	II	38.87	VII
Poor access to buying	35	VI	30.25	VIII	36.78	VI	39	VI	35.26	VIII
Lack of hygiene in purchase sources	31	VII	52.35	IV	45.67	IV	38	VII	41.76	V
Unavailability of preferred fishes	50	II	75.20	II	66.54	III	54	I	61.44	I
Restricted to social function	22	VIII	81.63	I	32.33	VII	29	VIII	41.24	VI
Tradition	18	IX	63.44	III	15.65	X	26	IX	30.77	IX
Lack of awareness	12	X	52.13	V	26.51	IX	15	X	26.41	X

fluctuations in price and lack of hygiene in purchase sources. The local fishermen of the area should be made aware of following good handling practices in order to fetch quality standards and good prices. Moreover, proper guidelines and practices could be adopted for increasing consumption and improving hygiene standards in the fish market.

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