



RESEARCH PAPER

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A preliminary survey of fish consumption at district Charsadda, Khyber Pakhtunkhwa, Pakistan

Inam Ul Haq¹, Ziagham Hasan², Ahsan Khan¹, Muhammad Latif¹, Qaisar Khan¹, Atiq Ur Rehman¹

¹Zoology Department, Islamia College Peshawar (A Public Sector University), Peshawar, Khyber Pakhtunkhwa, Pakistan

²Department of Zoology, University of Peshawar, Khyber Pakhtunkhwa, Pakistan

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Abstract

Present survey was conducted at District Charsadda Khyber Pakhtunkhwa from early January 2010 to November 2011 to know Fish Consumption on the basis of, 1) Fish consumption in relation to educational level, 2) Fish consumption in relation to age and gender, 3) Per Head consumption of fish, 4) Fish consumption on the basis of species liking, 5) Fish consumption on the basis of size, 6) Fish consumption in relation to time duration, 7) Order of preference given by people to meat, 8) Reasons for avoiding fish eating. The spectrum of the survey of this work was the district Charsadda, Khyber Pakhtunkhwa, Pakistan in 2012. For this purpose a Questionnaire was made, 305 Questionnaires were distributed of which only 266 samples were taken from the district Charsadda while the rest of 29 Questionnaires were unfilled as no one responded. So according to this survey results obtained were like this: 1) That fish eating habit was not much effected by educational level. 2) Among males consumption ratio was less than females and the consumption of fish was lowest among people having age group 46-55 years where as high among people having age group 26-35 years respectively. 3) per head consumption of fish in lower class was 0.40kg, while in middle class it bears 0.65kg but chased by 0.94kg in upper class. 4) Species liked by the people mostly were Silver carp, Rohu and Mahasher. 5) 20.37% people like small size fish and about 59.24% people like medium size fish and 20.68% consumes large sizes fish. 6) The percentage of people who consume fish once a week were 13.4% and similarly number of consumers who use fish twice a week were 6.5% and percentage of people consuming fish once a month were 22.95% while those serving fish bimonthly were 18.36% and yearly consumers of fish were 16.72% and 14% people use fish occasionally in parties and other recreational programmed. 7) It was concluded that 9.4% peoples use beef as meat, the result for mutton and fish were 20% and 33.96% respectively and chased by chicken as 36.98%. Reason for avoiding fish eating were smell, taste, spines, fear of leucoderma and high price. Overall, 87% respondents believed that there were health benefits from eating fish as reducing heart disease and high B.P. The main purpose of this study was to know approach and thinking of people at that area on different level toward the consumption of fish.

*Corresponding Author: Inam Ul Haq ✉ uzoologist@yahoo.com

Introduction

Charsadda is a town and headquarter of Charsadda District, in the Khyber Pakhtunkhwa province of Pakistan. Pashtuns make up majority of the population of the district. The district lies between 34-03' and 34-38' north latitudes and 71-28' and 71-53' east longitudes. Charsadda is located in the west of the Khyber Pakhtunkhwa and is bounded by Malakand District on the north, Mardan district on the east, Nowshera and Peshawar districts on the south and the Mohmand Agency of the Federally Administered Tribal Areas on the west. The total area of this district is 996 km². If we talk about history of Charsadda District so we became to know that, Charsadda District was once part of the kingdom of Gandhara. Gandhara was an ancient kingdom in the Swat and Kabul river valleys and the Pothohar Plateau, while in modern day in northern area Pakistan and eastern Afghanistan. However around 516 BC Gandhara became part of the seventh province of the Achaemenid Empire (The Achaemenid Empire or First Persian Empire, was an empire in Western and Central Asia, founded in the 6th century BC by Cyrus the Great (Sampson and Gareth 2008)) and paid tribute to Darius the Great of Persia, until its overthrow by Alexander the Great in the 4th century BC. After the death of Alexander in 323 BC the Indian Emperor Chandragupta Maurya rose to power and brought Gandhara under his sway. According to a popular tradition, Emperor Ashoka built one of his stupas there. This stupa was mentioned by the famous Chinese Buddhist pilgrim Hieun Tsang, who visited in 630, according to him Po-Lu-Sha (as he called the stupa) was 2.5 miles (4.0 km) in circumference. A Brahminical temple to the east and a monastery to the north which according to Buddhist legends was the place where Buddha preached the Law. The name Gandhara disappeared after Mahmood Ghazni conquered the area and converted it to Islam in 1026. This area was also ruled by the Bactrian Greeks between 250–125 BC which was succeeded by the Indo-Greek Kingdom who ruled until 10 AD.

Shabqadr is a small town in Charsadda tehsil 17 miles (27 km) north west of Peshawar. Here is a fort built by the Sikhs called Sharkargarh. The town was burnt by Mohmands in 1897. It has since been rebuilt. Bibi Syeda Dheri is a site half a mile to the north of Umarzai village in Charsadda tehsil here is a mound 60 ft (18 m) high. Believed to be the site of the stupa erected to commemorate the conversion by Lord Buddha of goddess Hariti who used to devour children of the locality. There is also a shrine of a lady saint Bibi Syeda. It is believed that a pinch of earth from the site is an effective antidote in the case of smallpox. Shar-i-Napursan is an archaeological site in Charsadda tehsil near the village Rajjar. Excavations have unearthed two distinct settlements of the Buddhist period and two of the Muslim period. Coins of Manander, Hermaeous and Kanishka have been unearthed. Palatu Dheri is another archaeological site near Charsadda tehsil. A mile from Shar-i-Napursan a mound which contains the remains of a stupa, which according to Hieun Tsiang, was built by one Deven and some coins which connect them both to the first century AD have been unearthed. Other finds include the image of the goddess Kalika-devi. Three inscribed jars, which were presented by some laymen to "the Community of the Four Quarters", are now in the Peshawar Museum.

The city of Charsadda originally known as Pushkalavati is first mentioned in the Hindu epic story the Ramayana. The district is administratively subdivided into two tehsils which contained a total of 46 Union Councils. The above all description about Charsadda district and about his history was taken from description of, Tehsils & Unions in the District of Charsadda-Government of Pakistan and Constituencies and MPAs - Website of the Provincial Assembly of Khyber Pakhtunkhwa. District Charsadda in Pakistan Map is shown in Fig.A. It is our common observation that increased production of food is a complex phenomenon for more economic development and reduced poverty. The food must

also be available to the people at a reasonable price and legislation must prohibit its illegal storage and black marketing. According to FAO aquaculture and fisheries has proved to be a solution to produce nutritive food stuff for the global population. So intensive aquaculture practices is seen as an alternative to meet the widening gap in global rising demand and decreasing supply of the nutritive food products (FAO, 2009).

Fishes are cold blooded vertebrates that breathe by means of gills and live in water. They live in all the seas, rivers, canals, lakes, dams, ponds and in almost every place where there is water. There are about 30,000 to 40,000 species of fishes differing widely from each other in shape, size, habits and habitat (Jordan and Verma, 1965). A fish is any member of a paraphyletic group of organisms that consist of all gill-bearing aquatic craniate animals that lack limbs with digits. Included in this definition are the living hagfish, lampreys, and cartilaginous and bony fish, as well as various extinct related groups. Most fish are ectothermic ("cold-blooded"), allowing their body temperatures to vary as ambient temperatures change, though some of the large active swimmers like white shark and tuna can hold a higher core temperature (Goldman 1997 and Carey 1973). Fish are abundant in most bodies of water. They can be found in nearly all aquatic environments, from high mountain streams (e.g. *char and gudgeon*) to the abyssal and even hadal depths of the deepest oceans (e.g. *gulpers and anglerfish*). Unlike groupings such as birds or mammals, fish are not a single clade but a paraphyletic collection of taxa, including hagfish, lampreys, sharks and rays, ray-finned fish, coelacanths, and lungfish. (Helfman *et al*, 1997). There are almost 28,000 known extant species, of which almost 27,000 are bony fish, with 970 sharks, rays, and chimeras and about 108 hagfish and lampreys (Nelson 2006). A third of these species fall within the nine largest families; from largest to smallest, these families are Cyprinidae, Gobiidae, Cichlidae, Characidae, Loricariidae, Balitoridae, Serranidae, Labridae, and Scorpaenidae. About 64

families are monotypic, containing only one species. The final total of extant species may grow to exceed 32,500 (Nelson 2006). There is 10,000 times more saltwater in the oceans than there is fresh water in the lakes and rivers. However, only 58 percent of extant fish species are saltwater. A disproportionate 41 percent are freshwater fish (the remaining one percent is anadromous). This diversity in freshwater species is, perhaps, not surprising, since the thousands of separate lake habitats promote speciation. (Bone and Moore 2008). Fish are found in nearly all natural aquatic environments (Bone and Moore 2008). Most fish, whether by species count or abundance, live in warmer environments with relatively stable temperatures (Bone and Moore 2008). However, some species survive temperatures up to 44.6 °C (112.3 °F), while others cope with colder waters; there are over 200 finfish species south of the Antarctic Convergence (Hogan 2011). Some fish species tolerate salinities over 10 percent (Bone and Moore 2008). The total number of fish species found in the Indus drainage is 189 of which 177 are recorded from the basin of Pakistan including 12 exotic species. Among the total fish fauna of this drainage, 65 species are found endemic of which 38 species are exclusively endemic to Pakistan (Rafique 2000). Fishing is an ancient activity of mankind. It has developed through world the centuries till today. Almost all countries have fishery development program. Fisheries development requires effective and efficient use of available resource, skills, capital, machine, money, management, finance and market (Joshi, 1996).

Fish consumption has undergone major changes in the past four decades. Consumption per person per year has been increasing from an average 9.9 kg in the 1960s to 16.4 kg in 2005. In the last years, China has accounted for most of the global growth in fish consumption, and their per capita fish supply was about 26.1 kg in 2005. Fish and seafood consumption varies greatly between different regions of the world, with local averages ranging from 1 kg to more than 100 kg per person per year. Many populations depend on it as part of their daily diets. Aquaculture

production is playing an increasing role in meeting the demand for fish and other fishery products. In 2006, it supplied nearly half of all fishery products for human consumption. Further growth in the availability of fish for human consumption is expected to come mainly from aquaculture. The current trends in fish consumption are expected to continue for the foreseeable future. In developing countries, a shift in diets towards more animal products will increase demand and, in industrialized countries, issues such as food safety and quality, environmental concerns, and animal welfare will probably be more important than price and income changes (FAO, 2008). Despite being the popular dish, the per capita consumption of fish in Pakistan is the lowest in the world with only 2kg per year compared to world average 17kg per year. As winter is knocking the door, sale of fish in the market started and a variety of fish is available in the market at affordable price. In Pakistan, fish is generally consumed during the winter season starting from October till April. The major reason for the low consumption is stated to be the fact that most of the produce is exported. According to official facts and figures, most of the fish catch in Pakistan is from marine sources, which is stated to be 70 per cent of the total fish exports. Pakistan exports fish mainly to Europe, US, Japan and Middle Eastern countries, accounting for only 0.25 per cent of world exports. From the existing natural resources, the total export potential has been estimated to be about \$1 billion (DAWN News, 2006). No such study was conducted before in this area. The main purpose of this study was to know approach and thinking of people at that area on different level toward the consumption of fish.

Methods and materials

Nature of research

In order to get information about the fish consumption, the survey was conducted at District

Charsadda K.P.K from early January 2010 to November 2011. People fishing, walking or engaged in other recreational activities in Charsadda, Haji Zai Pull and along Sir-deryab shore were interviewed. For this purpose a questionnaire was designed.

Selection of site

Parks, fishing piers and other open-access are visited on regularly, on weekdays and weekends at all time of the day (From 7:00 AM Until 6:00 PM). The target population of current study consisted of college students, workers and local people in district Charsadda.

Data collection

Stratified random sampling was done and questionnaires were distributed and filled from different strata of community. The data analysis was conducted in order to examine the difference in the consumption of fish in subgroups of consumers, after the collection of samples and interviews from the selected area, data was tabulated and analyzed.

Results

Results for fish consumption in relation to educational level

According to this survey, results for fish consumption in relation to educational level was like this: That among the illiterate people percentage of fish consumption was 100% both in males and females, the people whose education level was up to Primary the consumption was 100% in males and 88.88% in females. The percentage of fish consumption in Metric pass people was 77.77% in males and 100% in females, in Intermediate pass people the percentage was 83.3% in males and 100% in females. In Graduate and Post graduate the fish consumption was 63.3% and 95.65% in males while for female the percentage was 95.65% and 83.33% respectively. This result is also shown in Table.1 and Fig.1.

Table. 1. Showing results of Fish consumption in relation to education level.

Educational level	Male	Percentage	Females	%age
Illiterate	8/8	100%	25/25	100%
Primary	3/3	100%	8/9	77.77%
Metric	14/18	77.77%	15/15	100%
Inter	20/24	83.33%	25/25	100%
Graduate	38/60	63.33%	46/48	95.83%
Post. Graduate	44/46	95.65%	20/24	83.33%

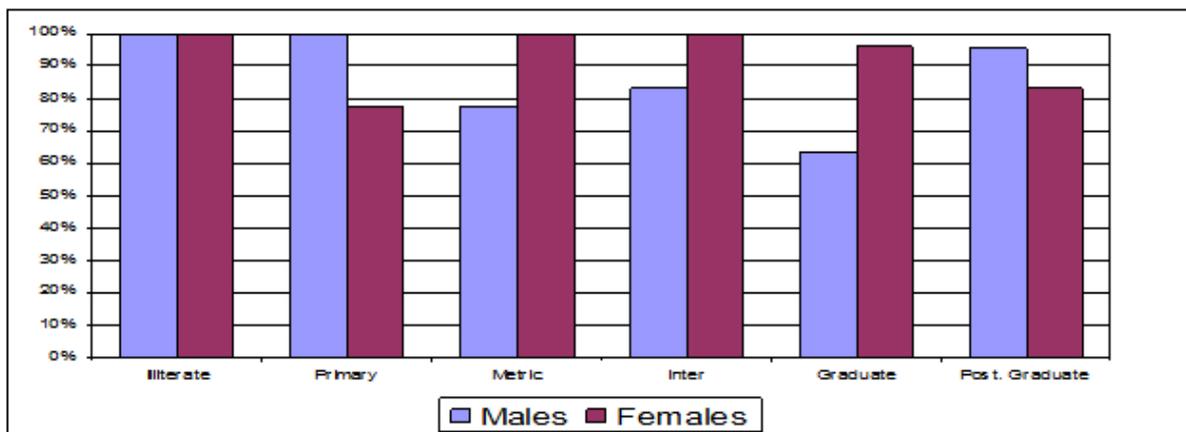


Fig. 1. Showing results of Fish consumption in relation to education level.

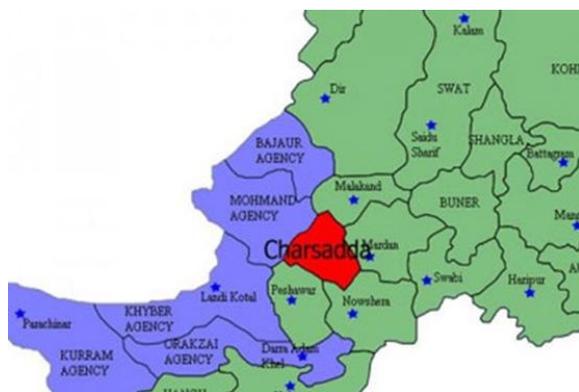


Fig. A. Showing distric Charsadda in Pakistan Map.

Results for fish consumption in relation to age and gender

According to this survey, results for fish consumption in relation to age and gender was like this: That according to the data obtained from the survey in Charsadda, the fish consumption percentage in people of age group 15-25 years in case of male was 87.5% while for females it was 95.8%. That whose age falls in between 26-35 years was 96.1% in male and 97.7% in females. The percentage for the people of age group 36-45 years was 87.5% in male and 73.9% in females. A data conducted from the people of age group 46-55 years the male had 80% and female had 82.6%, while the age group above 55 years was 81.25% in male and 90.32% in females. This result is also shown in Table.2 and Fig.2.

Table. 2. Showing results of Fish consumption in relation to age and gender.

Age(yrs)	Males	Percentage	Females	Percentage	Total
15-25	14/16	87.5%	33/33	100%	95.8%
26-35	50/52	96.1%	35/35	100%	97.7%
36-45	26/44	87.5%	42/48	87.5%	73.9%

46-55	24/30	80%	14/16	87.5%	82.6%
56-Above	13/16	81-25%	15/15	100%	90-32%

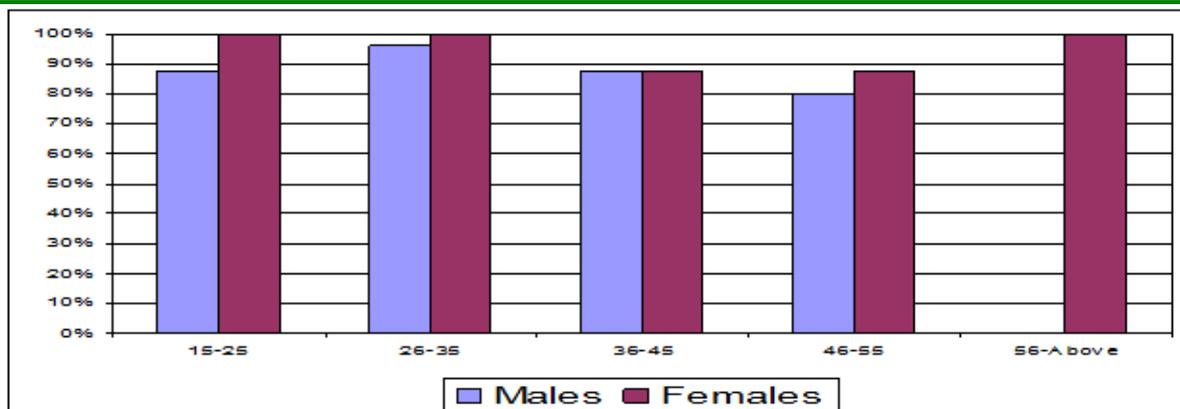


Fig. 2. Showing results of Fish consumption in relation to age and gender.

Results for per Head Consumption of fish

According to this survey, results for per Head Consumption of fish were like this: That in this part of survey per head consumption of fish was determined in different classes of the community. The per head consumption of fish in lower class was 0.40kg, while in middle class it bears 0.65kg but chased by 0.94kg in upper class. This result is also shown in Table.3 and Fig.3.

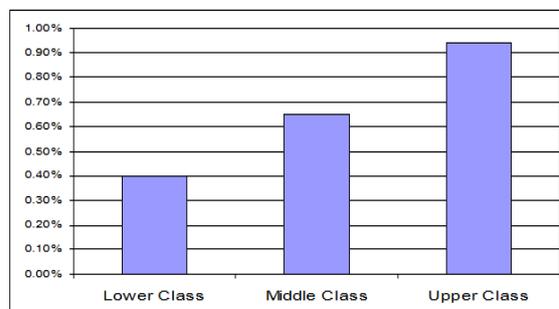


Fig. 3. Showing results of Per head consumption of fish.

Table. 3. Showing results of Per head consumption of fish.

Class level	No. of fish in kg/Total No. of consumers	Per head
Lower Class	46/ 114	0.40kg
Middle Class	233/356	0.65kg
Upper Class	388/409	0.94kg

Results for fish consumption on the basis of species liking

According to this survey, results for fish consumption on the basis of species liking were like this: That the percentage for consumption of Rohu is 14.7% while for silver carp the percentage was 52%, and for Mahasher it was 13.96%. This result is also shown in Table.4 and Fig.4.

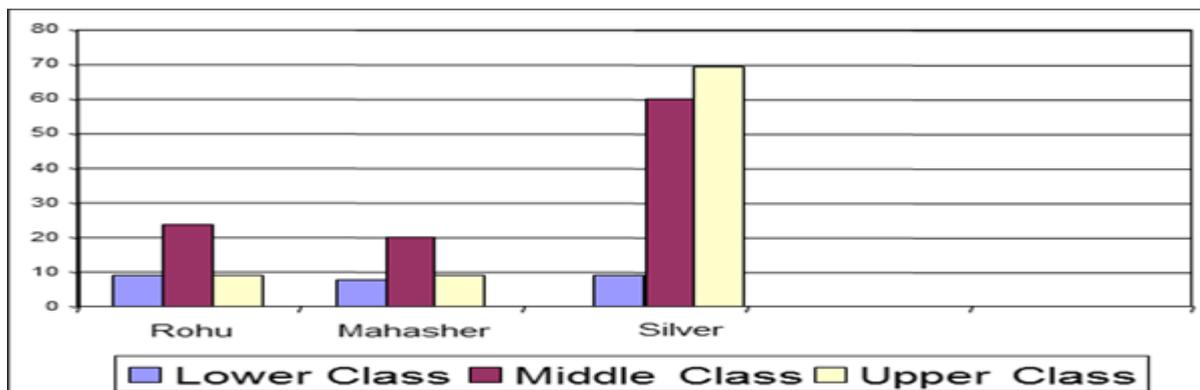


Fig. 4. Showing results of Fish consumption on basis of fish species liking the most by people.

Table. 4. Showing results of Fish consumption on basis of fish species liking the most by people.

Class level	Rohu	Mahasher	Silver
Lower Class	6	8	9
Middle Class	24	20	60
Upper Class	9	9	69
Total	39	37	138
Percentage	14.7%	13.96%	52%

Results for, reasons for avoiding fish

According to this survey, results for, reasons for avoiding fish was like this: That according to this survey about 11.3% peoples avoid fish consumption due to its smell and 22.64% people avoid fish consumption due to minute spines in them. About 7.92% people avoid fish due to fear of leucoderma.

The most important reason due to which people avoid fish in their diet is its high price (43% in Charsadda).4.5% people give other reasons for avoidance of fish meat eating. This result is also shown in Table.5 and Fig.5.

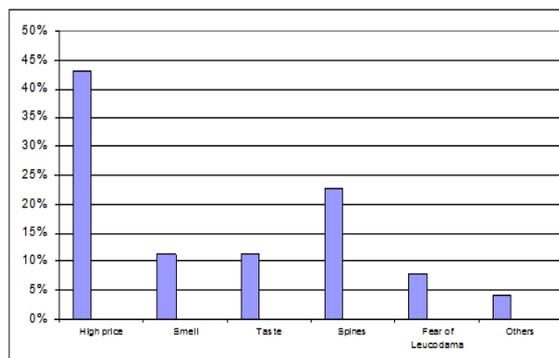


Fig. 5. Showing results of Reasons that why people avoids fish eating.

Table. 5. Showing results of Reasons that why people avoide fish eating.

Class level	High price	Smell	Taste	Spines	Fear of Leucodama	Others
Lower Class	12	5	4	5	-	4
Middle	85	10	10	15	13	-
Upper Class	17	15	16	40	8	7
Total	114	30	30	60	21	11
% age	43%	11.3%	11.3%	22.64%	7.92%	4.15%

Results for fish consumption on the basis of size

According to this survey, results for, fish consumption on the basis of size was like this: That according to this study 20.37% people like small size fish. About 59.24% people like medium size fish and 20.68% consumes large sizes fish. This result is also shown in Table.6 and Fig.6.

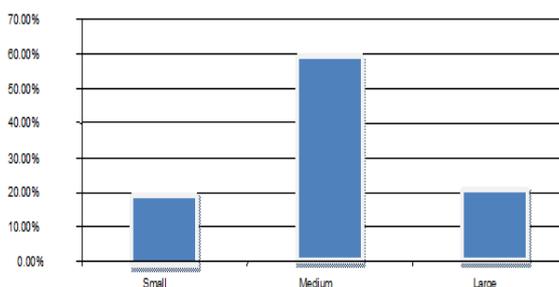


Fig. 6. Showing results of Fish consumption in relation to size.

Table. 6. Showing results of Fish consumption in relation to size.

Class level	Small	Medium	Large
Lower Class	4	16	10
Middle Class	23	76	34
Upper Class	27	65	11
Total	54	157	55
Percentage	20.37%	59.24%	20.68%

Results for fish Consumption in relation to time duration

According to this survey, results for, fish Consumption in relation to time duration was like this: That According to duration of time that how much importance people give to fish as a source of food. It was conducted that in Charsadda the

percentage of people who consume fish once a week is 13.4%. Similarly number of consumers who use fish twice a week is 6.5%.The percentage of people consuming fish once a month is 22.95% while those serving fish bimonthly is 18.36%. The yearly

consumers of fish are 16.72% and 14% people use fish occasionally in parties and other recreational programmers. While 12% show nil response in this case. This result is also shown in Table.7 and Fig.7.

Table. 7. Showing results of Fish consumption in relation to time duration.

Class level	Once a week	Twice a week	Once a month	Bimonthly	Yearly	Occasionally	Nil
Lower Class	0	3	4	8	3	12	13
Middle Class	12	8	34	20	30	29	17
Upper Class	29	9	32	13	18	2	9
Total	41	20	70	56	51	43	39
Percentage	13.4%	6.5%	22.95%	18.36%	16.72%	14%	12.7%

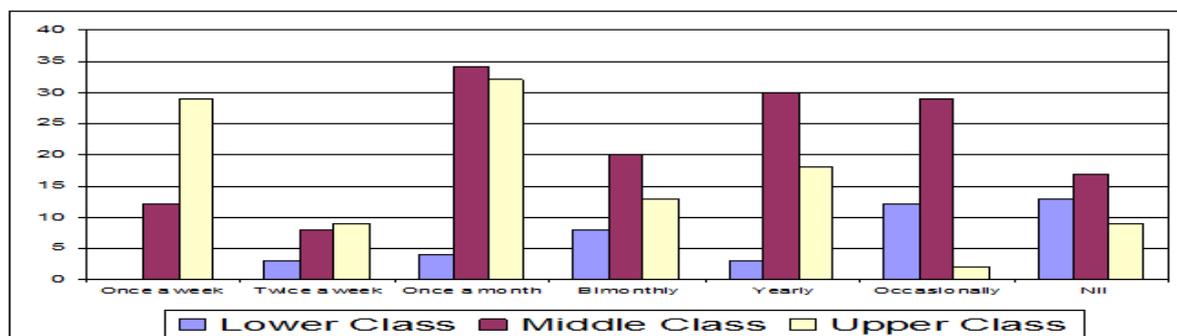


Fig. 7. Showing results of Fish consumption in relation to time duration.

Results for, Order of Preference given to meat

According to this survey, results for, Order of Preference given to meat was like this:

That in this part of survey it was concluded that 9.4% peoples use beef as meat, the result for mutton and fish were 20% and 33.96% respectively, but chased by chicken as 36.98% peoples consume and give more preference to use chicken in their daily food menu the reason was its more availability and low price. This result is also shown in Table.8 and Fig.8.

Discussion

Fish consumption has undergone major changes in the past four decades. Consumption per person per year has been increasing from an average 9.9 kg in the 1960s to 16.4 kg in 2005. In the last years, China has accounted for most of the global growth in fish consumption, and their per capita fish supply was

about 26.1 kg in 2005. Fish and seafood consumption varies greatly between different regions of the world, with local averages ranging from 1 kg to more than 100 kg per person per year. Many populations depend on it as part of their daily diets. Aquaculture production is playing an increasing role in meeting the demand for fish and other fishery products. In 2006, it supplied nearly half of all fishery products for human consumption. Further growth in the availability of fish for human consumption is expected to come mainly from aquaculture. The current trends in fish consumption are expected to continue for the foreseeable future. In developing countries, a shift in diets towards more animal products will increase demand and, in industrialized countries, issues such as food safety and quality, environmental concerns, and animal welfare will

probably be more important than price and income changes (FAO, 2008).

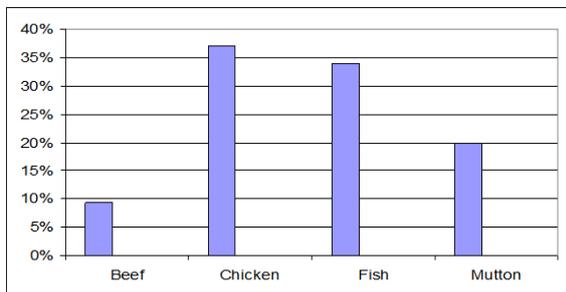


Fig. 8. Showing results of Order of preference given by people to meat.

Table. 8. Showing results of Order of preference given by people to meat.

Class level	Beef	Chicken	Fish	Mutton
Lower	4	12	8	6
Middle	7	43	34	19
Upper	14	43	48	28
Total	25	98	90	53
%age	9.4%	36.98%	33.96%	20%

Fish production increased from 446,000 tons in 1988 to 510,000 tons in 1992, thus showing an average growth of 3.5 per cent, per annum. Out of the total production of fish about 32 %of the edible catch is consumed as fresh, 8% is for canning, freezing 9%, subsistence 8% and the remaining 43 % is for fish meal. Pakistan exports considerable quantities of fish and fish products to European and Middle East countries. Export of fish and fish products increased from 47,000 tons worth \$94.40 million in 1989-90 to 66,000 tons worth \$114.71 million in 1991-92, thus showing an increase of 10 per cent annum in terms of value. The per capita consumption of fish in the country is very low i.e. 2 kg. Pakistan earned about \$115 million from the exports of fish and shrimp products in 1991-92 which is 1.7 per cent of our total export earnings. The principal importing countries during the year 1991-92 were Japan, USA, UK, and Sri Lanka. Fish consumption in Pakistan is the lowest at 3.09 kg. There is hardly any improvement in the per capita consumption of fish. In European countries

per capita consumption of fish is 20 Kg, and in Japan it is 78 Kg, and Bangladesh 11 Kg (Shaikh, 2011).

Despite being the popular dish, the per capita consumption of fish in Pakistan is the lowest in the world with only 2kg per year compare to world average 17kg per year. In Pakistan, fish is generally consumed during the winter season starting From October till April. The major reason for the low consumption is stated to be the fact that most of the produce is exported. According to official facts and figures, most of the fish catch in Pakistan is from marine sources, which is stated to be 70 Percent of the total fish exports. Pakistan exports fish mainly to Europe, US, Japan and Middle Eastern countries, accounting for only 0.25 per cent of world exports. From the existing natural resources, the total export potential has been estimated to be about \$1 billion (DAWN News, 2006).

From an annual report data 1972-1973 and 1991-1992, food consumption patterns in Pakistan have changed during the last two decades. Consumption of meats has increased while the consumption of lentils has steadily decreased. Although the consumption of mutton and chicken has steadily increased since early 1970s, beef consumption increased only in mid-eighties after remaining constant in the earlier period. Fish consumption has also remained constant during this entire period. Per capita chicken consumption which doubled in the first seven years continued to grow even faster in the 1980s (Burki, 1997).

The chill in the air following recent spell of rains has caused an increase in the number of stalls offering fish of different species, cooked or uncooked, at various points of the city, receiving a huge rush of customers. Fish nowadays is selling like hot cakes and according to estimates around three tons of it arrives every day at Ganjmandi, which is the main wholesale fish market in Rawalpindi that supplies the commodity to the twin cities. Almost all eateries of the city are offering fish on their menu, while there are certain kiosks that have earned a name

specifically for their finger licking fish recipe (Khalid, 2010).

Omega 3 fatty acid is very important for normal growth particularly for the blood vessel and the nerves as well as keeping our skin and other useful supply. They help lower cholesterol as well as reduce the symptoms of many other diseases like Asthma, Gallstones, Psoriasis, Atherosclerosis, Rheumatoid, Arthritis and most importantly the heart diseases. (Michael Lucas, 2008)

According to the Department of Obstetrics and Gynecology cycling women both taking or not taking oral contraceptives and menopausal women on replacement estrogen ingested 3 g daily of marine fish oil for 30 days. Triglycerides decreased in the contraceptive users, cholesterol and LDL increased in the non-contraceptive user; while LDL decreased in the menopausal women. After 14 days removal of the fish oil, lipid profiles generally returned to a pattern generally thought to be harmful. Fish oil appears to alter lipids favorably in women receiving exogenous estrogens compared to natural circulating estrogen (Lox, 2003).

Omega-3 fatty acids, or fish oil, are polyunsaturated fats found in fish, fish oil, and in the form of supplements. They typically consist of a combination of polyunsaturated fatty acids that include DHA (docosahexaenoic acid) and EPA (eicosapentaenoic acid). Polyunsaturated fats, especially EPA and DHA, have a reputation for being heart-friendly fats because they do not promote atherosclerosis associated with causing heart disease. Previous research has shown that individuals consuming omega-3 fatty acids have decreased risk of sudden death from heart disease. Recent research has indicated that it may also lower the risk for heart disease by improving your lipid profile. So, does it help lower triglyceride and cholesterol levels (Moll, 2010).

Greater fish oil consumption has been associated with reduced CVD risk, although the mechanisms are

unclear. Plant-source oil omega-3 fatty acids (ALA) have also been studied regarding their cardiovascular effect. The study shows that beneficial effect of fish oil on serum triglycerides, particularly among people with more elevated levels. Fish oil consumption also modestly improves HDL cholesterol, increases LDL cholesterol levels, but does not appear to adversely affect glucose homeostasis. The evidence regarding the effects of omega-3 fatty acids on hs-CRP is inconclusive, as are data on ALA (Balk *et al* 2006).

Omega-3 fatty acids have been shown to significantly reduce the risk for sudden death caused by cardiac arrhythmias and all-cause mortality in patients with known coronary heart disease. Fatty fish, such as salmon and tuna, and fish oil are rich sources of the omega-3 fatty acids eicosapentaenoic acid and docosahexaenoic acid. Flaxseed, canola oil, and walnuts also are good dietary sources of omega-3 fatty acids. In addition to being antiarrhythmic, the omega-3 fatty acids are antithrombotic and anti-inflammatory. In contrast, omega-6 fatty acids, which are present in most seeds, vegetable oils, and meat, are prothrombotic and proinflammatory. Omega-3 fatty acids also are used to treat hyperlipidemia, hypertension, and rheumatoid arthritis. Increased consumption of vegetable oils high in omega-6 fatty acids (such as corn, safflower, sunflower, and cottonseed oils) and meats from animals that were fed grains high in omega-6 fatty acids has drastically shifted the dietary ratio of omega-6 to omega-3 fatty acids from an estimated 1:1 in the early human diet to approximately 10:1 in the typical modern American diet (Maggie and Covington, 2004).

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