Impact of climatic conditions on treatment and prevalence of common diseases of fish, in Dera Ismail Khan, Khyber Pakhtunkhwa

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ABSTRACT

The study was conducted in Dera Ismail Khan, District of Khyber Pakhtunkhwa, to analyze the common diseases and their prevalence. A questionnaire was prepared and a total of 100 fish keepers were interviewed. The most prevalent disease symptoms reported by the fish keepers were red spots, red rashes on the skin, abnormal body parts, tail and fin rot, gill rot, and white spot on the skin. Other conditions with specific infection include red mouth, pale color, mouth disease (grey, red, white line around lips) caused by *Fexibacteria*, *Branchiomycosis* (gill disease), *Ichthyophthriasis* (white spot disease), neurological bacterial disease (*Streptococcus* spp), *Flavobacterium columnare* (Columnaris disease), *Costiasis* (grey patches on the skin), and *Trichodina* (Attack on fish skin and gill). No viral diseases were observed in hatcheries. The fish keepers mostly use $KMnO_4$, Kanamycin, and Sodium bicarbonate against bacterial and fungal infections. Lack of technical expertise by the fish keepers about the fish health, lack of assistance from the government, unavailability of appropriate therapeutics and lack of knowledge leads to these diseases.

Keywords: Fish, diseases, treatment, control

1. INTRODUCTION

New technological advances and expanded needs for fish as a source of animal protein are the main reasons for the increase in fish production. Because of the industry's growth, the culture strategies have become greater extensive for producing higher yields [1]. In 2014, aquaculture manufacturing of fish made up 44% of general fish production; that is seventy-four million lots of fish worth 160 billion greenbacks [3]. The fishes are now not handiest play an essential function in the demand of meals for human beings but they've

also emerged as critical version organisms for extraordinary biomedical research [2]. Massive lack of production in aquaculture is occurring due to the fact of many reasons. Amongst these reasons, a disorder is the most severe constraint that causes harm to the livelihood of fish keepers, loss of a task, decreased incomes, and food insecurity. For instance, infectious salmon anaemia alone fees 2 billion greenbacks in Chile and brings about 20,000 employees to lose their jobs [3].

Mainly, stress, which includes herbal droughts or pollutants or predators, can precipitate outbreaks of sickness. Infectious illnesses of fish result from pathogenic organisms' gifts in the environment or carried by other fish. They're contagious sicknesses, and some sort of treatment can be vital to control the ailment outbreak. In assessment, non-infectious illnesses result from environmental troubles, nutritional deficiencies, or genetic anomalies; they're not contagious and generally cannot be cured through medicines [4].

Infectious diseases are broadly categorized as parasitic, protozoan, bacterial, viral, or fungal diseases. Parasitic fish illnesses spread due to protozoans that infest the gills and skin of fish, causing infection, weight reduction, and dying sooner or later [5]. *Ichthyophthiriasis* (ICH) causes simple hyperplasia of the epidermal, the appearance of whitish cysts at the skin, gill and fins [6]. Indicators of costiasis are a bluish coating on the pores and skin of the fish and the presence of a large quantity of mucus. The parasite causes inflammation and disturbs breathing [7]. Similarly, *Trichodina, Epistysis* (Red sore disease), and *Myxosporidians* infestation are familiar.

Fish are prone to several bacterial infections, especially while reared in extreme density situations [2]. Bacterial infections are considered the fundamental cause of mortality in aquaculture [8]. Disorder outbreaks increase the mortality rate and reduce product performance, causing an excessive economic loss of the fish keepers [2].

S. agalactiae, L. garvieae and *E. faecalis* are carefully related corporations of microorganisms that may purpose sicknesses like *Streptococcus, Lactococcus, Hemorrhagic septicemia* (HS) and ulcers in fins [9]. The two acute viral diseases are spring viremia and fish pox [10]. The three most common fungal diseases are *Saprolegniasis, Branchiomycosis* (Gill Rot) and *Icthyophonus* (Swinging disease) [6, 11]. Non-infectious diseases can be broadly categorized as environmental, nutritional, or genetic. Environmental diseases are the most vital in business aquaculture; comprised of low dissolved oxygen, high ammonia, excessive nitrite, or natural or guy-made toxins inside the aquatic surroundings. Nutritional illnesses may be complicated to diagnose. A classic example of a dietary disease of catfish is "damaged again disorder" due to vitamin c deficiency. The lack of dietary vitamin c contributes to incorrect bone development and the spinal column's deformation. Catfish's other crucial dietary ailment is "no blood disorder," which may be related to a folic acid deficiency. Genetic anomalies include conformational oddities consisting of a different tail or lack of a tail [4].

The non-unique defences of fish used against pathogens consist of the pores, skin, scales, and the mucus layer secreted using the epidermis, which traps and inhibits the boom of microorganisms. In the latest years, the vaccines have grown to be extensively utilized in aquaculture and ornamental fish, e.g., the *Furunculosis* vaccines in farmed salmon and koi herpes virus in koi. A few species of fish use the cleanser fish to dispose of external parasites. The first-class known is the blue streak of the genus Labroides found on coral reefs in the Indian and Pacific oceans [12]. For ICH disorder, dip for the hourly duration, in 1:5,000 formalin solution for 7 to ten days, or in 2% standard salt solution for more than seven days, or in 1:50,000 quinine solution for three to ten days should be used [13]. *Bodomonas rebae* has been killed in five to ten minutes using 2 to a few% not unusual salt solutions [7].

In *Trichodiniasis*, chelated copper compounds were used, which might be extremely powerful in opposition to the protozoan parasite. The copper compounds, e.g., argent and aquavit, are to be had in the market. In dropsy, thorough disinfection is accomplished with one ppm potassium permanganate solution, or dip treatment in 5 ppm of the identical chemical for two minutes can be given [14]. Great care needs to be taken to prevent the movement of the disease to non-infected areas. The uses of advanced husbandry/management practices, movement restrictions, genetically resistant inventory, nutritional dietary supplements, nonspecific immune stimulants, vaccine, probiotics prebiotics, medicinal plant merchandise, water disinfection biological

control, antimicrobial compounds, water disinfection, and control of movement are the first-rate methods on top of things of infectious illnesses of fish [15]. Antibiotics are underneath strict management and regulatory measures due to drug resistance and residue-related troubles [16]. The current study investigates the common diseases in fish and their possible treatments/preventions used by the fish keepers.

2. METHOD AND MATERIAL

2.1. Study location

The area of study is district Dera Ismail Khan, located in Khyber Pakhtunkhwa, Pakistan. It is located at 32 °6' 8 N and 70 °58'12 E and Kulachi is another nearest city to Dera Ismail located at 31 °55'49 N 70 °27'31 E.

2.2. Data collection

Data were collected through questionnaire interviews and personal contact. A total of 150 participants was involved in data collection through this method. The primary origin for data collection was ponds and rivers. Participants were involved in this study based on their past experiences. For the questionnaire survey, a set of preliminary questionnaires based totally on the observation goals were organized. The initial questionnaire changed into tested twice at the sector degree with few fish keepers and based totally on the reaction; the very last set questionnaire became organized. For the interview, a straightforward random sampling approach was observed [17].

2.3. Statistical Analysis

All the data were statistically analyzed using descriptive statistics with IBM SPSS Statistics 21 software [18].

3. RESULTS AND DISCUSSION

3.1. Contents of fish feed

In different hatcheries of Dera Ismail Khan and adjacent cities, the contents of fish feedings were almost the same. Proteins and Carbohydrates are most important in the fish diet. Table 1 shows the maximum percentage of these two, i.e., 57.9% because it is considered the most beneficial feed diet of fishes. 5.3% shows the minimum percentage of meat and minerals. There are about six different varieties in the contents of fish feeding, as mentioned in Table 1. The mean of the contents of fish feed was 4.16, and the standard deviation was ±2.24. All the fish feeds content, i.e., Proteins,

Table 1. Showing the contents of fish feed in different hatcheries

Fish Contents	Frequency	Percent	Cumulative Percent
Protein plus Carbohydrates	11	57.9	57.9
Protein	3	15.8	73.7
Carbohydrate	2	10.5	84.2
All plus Meat	1	5.3	89.5
All plus minerals	1	5.3	94.7
Meat	1	5.3	100.0
Total	19	100.0	
Mean 4.1579		Std. Deviation	± 2.24260

Table 2. The depth of different ponds from various location

Depth of pond	Frequency	Percent	Cumulative Percent
5 feet	1	5.3	5.3
7 feet	5	26.3	31.6
6 feet	3	15.8	47.4
4-5 feet	3	15.8	63.2
6-7 feet	1	5.3	68.4
9 feet	2	10.5	78.9
5 feet	2	10.5	89.5
4 feet	2	10.5	100.0
Total	19	100.0	
Mean 4.1579		Std. Deviation	±2.24260

Table 3. The count of feeding times of fish per day

Feeding Time	Frequency	Percent	Cumulative Percent
2 times	11	57.9	57.9
2 or 3 times	2	10.5	68.4
3 times	2	10.5	78.9
1 time	4	21.1	100.0
Total	19	100.0	
Mean 2.1579		Std. Deviation	± 1.70825

Table 4. Usage of various fish feed with different composition			
Fish Feed	Frequency	Percent	Cumulative Percent
Gluten, Barley, maize	1	5.3	5.3
Wheat, Barley, wheat	1	5.3	10.5
Soybean, rice, gluten, Barley	1	5.3	15.8
Gluten, wheat	1	5.3	21.1
Wheat, Barley	1	5.3	26.3
Wheat	1	5.3	31.6
Maize, Gluten	1	5.3	36.8
Karl, maize, gluten	1	5.3	42.1
Rice polish, DP, Urea	1	5.3	47.4
Rice polish, Aqua floating, maize, insects	1	5.3	52.6
Maize, rise	1	5.3	57.9
Karl, treacle	1	5.3	63.2
Mustard, rice powder, maize, insects	1	5.3	68.4
Rice polish	1	5.3	73.7
Rice, wanda	1	5.3	78.9
Corn, wheat, rice polish	1	5.3	84.2
Insects and larvae	2	10.5	94.7
Plants, fruits, insects	1	5.3	100.0
Total	19	100.0	

carbohydrates, meat, and minerals were well defined.

3.2. Depth of fish pond

Pond's depth varies in study areas. 4-7 feet are considered the best and accurate depth of a pond. If the depth of the pond is more, an oxygen problem can occur. Mostly there are small and considerable ponds. When small fish are transformed into big fish, more depth and oxygen are required. On some locations, only a single pond is used for both small and big size fish. In the study area, 7 Feet depth was considered best because it is suitable for fingerlings and adult fish. Table 2 shows 26.3% of 7 feet pond's depth. The medium percentage is 15.8% which is 4-6 feet depth. The mean depth of ponds is 4.16, and the standard deviation is ±2.24. It means that the result is

correct, as shown in below Table 2. Growth performance and survival rate of fishes in hatchery are significantly affected by pond depth and water temperature [19]. Optimum depth leads to better production rates.

3.3. Fish feeding times per day

The feeding time of fish is between 2 times per day. Excess of feeding causes disease in them. Morning time is more suitable for fish than other timing. The maximum percentage was 57.9% for two-time fish feeding, and 21.1% shows a medium percentage of one-time fish feeding, while frequency 2 shows a small percentage of three-time fish feeding,(Table 3). The mean of the feeding times of fish is 2.16, and the standard deviation is ±1.71. Fishes are poikilothermic, therefore their body temperature and metabolic rate depends on the
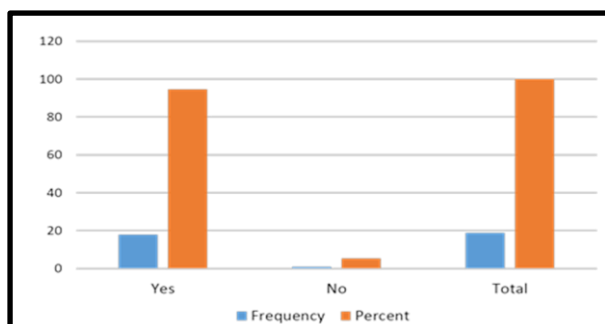
Figure 1. Usage of Chemical fertilizer in fish hatcheries
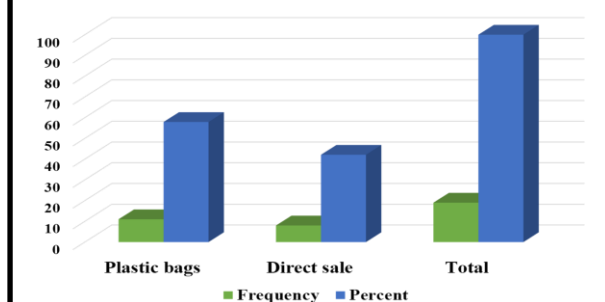
Figure 2. Mode of transportation of fish from hatcheries

water temperature and this has practical implications for the nutrition, feeding and health of fish. The Nutrition and feeding per day highly influence growth, reproduction, and health of fish like any other organism. But right amount of nutrition provide better response to physiologic and environmental stressors and pathogens [20].

3.4. Fish Feed
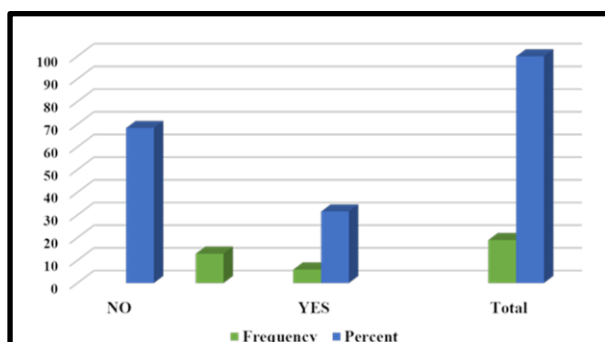
Figure 3. Different types of feed given to fingerlings and adult fish

It is found that there are varieties of feed available for fish. One type of food causes problems in fish. Aqua floating (food variety) is used for increasing fish production. Artificial feed for fish includes larvae/insect food [21]. Excessive feeding of fish in fish ponds can lead to overfishing of feed and causes various diseases, including digestion problems, toxicity, etc. In the total feed contents of fish, the insects and larvae are preferred by fish that is why it is used in large quantities. Table 4 shows that insects and larvae have 10.5% used in fish feed, which is highest compared with other contents.

3.5. Breeding months of fish

Every fish hatcheries have its breeding month because some reproduce them artificially. The breeding month usually from March to August, is favourable for fish. Some fish hatcheries have the breeding time for Rohu fish in June to August, the Grass Carp in April-May, the Silver Carp in May-June, Mori in July-Aug, and Gulfam fish breeding in March-April [22]. Table 5 shows that the highest breeding percentage of fish is in June-July, i.e., 15.8% and after that, in June-August, i.e., 10.5%, while other months show the smallest percentage of 5.3%.
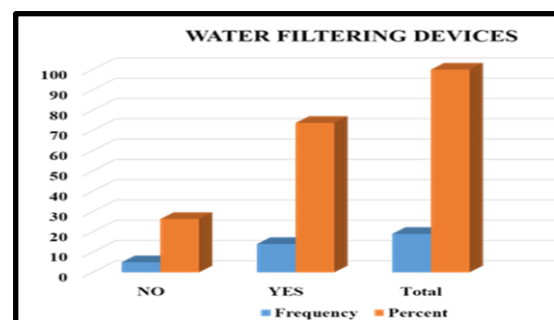
Figure 4. Water filtering devices are used in most hatcheries, and only some do not use them

Table 5. The cause of diseases in fishes in hatchery			
Diseases Name	Frequency	Percent	Cumulative Percent
Excess Ammonia, Water pollution, pH changes	1	5.3	5.3
Disease also occurs due to food contaminated water, etc.	2	10.5	15.8
Net, food, water pollution	1	5.3	21.1
Food, sudden change in pH, the lake of pond cleaning, unknown diseases, ammonia, etc.	1	5.3	26.3
pH disturbance, ammonia excess, net, food etc.	1	5.3	31.6
Change in pH, polluted water, etc.	1	5.3	36.8
pH , food	1	5.3	42.1
Fungus, larvae, pH etc.	1	5.3	47.4
pH	3	15.8	63.2
Fungus, larva	1	5.3	68.4
Oxygen deficiency	1	5.3	73.7
Maintaining in pH	1	5.3	78.9
Polluted water, pH, oxygen deficiency, food	1	5.3	84.2
Because of feeding, pH, contaminated water	1	5.3	89.5
Ammonia excess	1	5.3	94.7
Contaminated water	1	5.3	100.0
Total	19	100.0	
Mean 8.2105		Std. Deviation	±4.60161

Table 6. Various kind of problems faced by fishes in hatchery			
Problems in the hatchery	Frequency	Percent	Cumulative Percent
Electricity, diseases, pH	3	15.8	15.8
pH and ammonia maintaining ,etc.	1	5.3	21.1
pH, water pollution, lack of knowledge about diseases	1	5.3	26.3
Diseases, pH	1	5.3	31.6
Water pH, water pollution, etc.	1	5.3	36.8
pH, Nitrate control	1	5.3	42.1
pH, nitrate, nitrite, ammonia control	1	5.3	47.4
pH	2	10.5	57.9
Water shortage	1	5.3	63.2
Feed shortage, temp, electricity	1	5.3	68.4
Feed shortage	1	5.3	73.7
Disease control, electricity, water shortage	1	5.3	78.9
Water, disease, feed	1	5.3	84.2
Maintain water condition and freshwater maintenance	1	5.3	89.5
Water, the best environment	1	5.3	94.7
Electricity, pH maintenance	1	5.3	100.0
Total	19	100.0	

3.6. Use of Chemical Fertilizers

There are 3-4 types of chemical fertilizers used in different areas of Dera Ismail Khan and the nearby regions of D. I. Khan. Urea is the most usable Chemical Fertilizer in most hatcheries. However, some hatcheries don't even use single chemical fertilizers; they believe that even if they stop applying food and fertilizers, the fish will not die because there is natural food in the water. Chemical fertilizer is used in almost every fish hatchery of Dera Ismail Khan which is similar to other studies stating that chemical

Table 7. The average weight of mature fishes			
Fish Weight	Frequency	Percent	Cumulative Percent
2.5 kg	2	10.5	10.5
Mori(1 Kg), Rohu (1.5 Kg),silver (2 Kg), grass carp(2.5 Kg)	1	5.3	15.8
Depend on specific fish	1	5.3	21.1
2 kg	2	10.5	31.6
6 kg	1	5.3	36.8
6-7 kg	1	5.3	42.1
Weight 2 to 3 kg	1	5.3	47.4
3 k young and 7 kg old fish	1	5.3	52.6
1.5-2 kg. 15 inch	1	5.3	57.9
All fish 1 .5 kg	1	5.3	63.2
1 Kg	1	5.3	68.4
2.5 kg and Thela plus grass is 4-5 kg weight	1	5.3	73.7
2 kg silver and thela. 1.5 kg sol, rakhi and rohu	1	5.3	78.9
1.5 kg	2	10.5	89.5
1.5-2.5 kg	1	5.3	94.7
4 kg	1	5.3	100.0
Total	19	100.0	

fertilizers are widely used [23]. It increases fish food productivity and is readily available at any time. In Figure 1, 94.7% shows chemical fertilizer which is the highest percentage. The value 5.3% shows the minimum percentage of Chemical fertilizer in hatcheries where it is not used. The mean of the use of chemical fertilizer is 1.05 and the standard deviation is ±22.9, which shows accurate results.

3.7. Transportation of Fish

The transport of fish is basically through polythene (plastic bags) bags because it is the cheaper method used in most areas. However, in some areas, the owner direct sells their fish after reaching maturity. Figure 2 shows the percentage of plastic bags used for transportation, i.e., 57.9%. In comparison, 42.1% is the percentage where they direct sell fish for business only. The mean of the methods for transportation of fish is 1.42. The standard deviation is ±0.50.

3.8. Causes of Diseases

Various causes of diseases were observed in the hatcheries, like excess ammonia, pH disturbance, contaminated water, oxygen deficiency. If the amount of carbon dioxide in the water increases and oxygen decreases, it will lead to diseases like their gills get stuck and the normal movement of fish will disturb [24]. The most common cause of fish diseases is a sudden change in pH and excessive feeding. Fish catching by net sometimes causes injury, resulting in many diseases, i.e., fungal and bacterial diseases. Among different causes of diseases in the hatchery, the leading and common cause is pH disturbance. Sometimes, it is challenging to balance and maintain the pH of water, which causes diseases in fish [24]. Table 6 shows the maximum percentage, i.e. 15.8%, for the diseases caused by pH disturbance, and 10.5% shows the percentage of diseases caused due to feeding, water and food contamination. In comparison, 5.3% shows the minimum

Table 8. The analysis made for infected fishes			
Analysis of infected fish	Frequency	Percent	Cumulative Percent
Skin sore, pale color of gills, mouth spot	1	5.3	5.3
Skin rashes wound on the skin, slow motion, abnormal body parts e.g., bigger head and smaller body	1	5.3	10.5
Stop eating, rubs its body due to irritation, slow movement, etc.	1	5.3	15.8
Irritation, stop eating, changes in skin color, wounds on gills, bulging eyes.	1	5.3	21.1
Skin sores, swollen abdomen, bacterial infection, white pimples on skin and fins.	1	5.3	26.3
Rashes and wounds on the skin, difficulty in feeding	1	5.3	31.6
Don't eat food, stick out their head from the pond for oxygen, pale color	1	5.3	36.8
Don't eat, pale color, etc.	1	5.3	42.1
Don't eat	2	10.5	52.6
Skin rashes. do not eat, come upward, rub their skin with soil, jump backward	1	5.3	57.9
Do not eat, jump outside, keep opening their mouth, rub their skin	1	5.3	63.2
Pulls its head out of the pond.	2	10.5	73.7
Skin rashes	1	5.3	78.9
Wound on the skin, slow motion, rub their skin	1	5.3	84.2
Wounds on the skin, do not eat	1	5.3	89.5
Mouth sides are woody	1	5.3	94.7
Redness on skin	1	5.3	100.0
Total	19	100.0	

percentage of infections caused by excess ammonia, the lake of pond cleaning, oxygen deficiency, and the net for catching the fish. The mean of the causes of diseases in the hatchery is 8.21 and the standard deviation is ±4.60.

3.9. Problems of hatcheries

Observed many problems in hatcheries like pH maintenance, feed shortage, and the pervasive in hatcheries: control of disease and electricity. Most people don't know about diseases because of the lack of knowledge. Electricity is required to filter the water by using water filtering devices like aerators [24]. Electricity is also needed for various machines to work, like a motor machine that produces water. 15.8% shows the maximum percentage of problems in the hatchery is due to electricity. The smallest percentage is 5.3%, showing other problems like ammonia, water pollution, feed shortage, nitrate, nitrate, etc (table 7).

3.10. Weight of mature Fish

Every fish has a different size. The size is generally range between 2-7 kg for various fish. The size observed for Mori and Rohu, sol, rakhi fish in 1 year was 1 Kg while Silver, Grass Carp, and Thela in 2 years was 2-2.5 Kg. Also, the exact size of fish, 6-7 kg, for Rohu, silver, Grass Carp, Mori, Thela, etc., have been observed. The size at maturity of fish is between 1.5, 2 to 2.5 Kg, as mentioned in the Table 8, which has the maximum percentage, i.e., 10.5%, while the

Table 9. Different types of medication used by the owner for infection control			
Medicine	Frequency	Percent	Cumulative Percent
Medicine Related to diseases	1	5.3	5.3
KMno4, Sulphur solution, hydrogen peroxide. etc.	1	5.3	10.5
Potassium, $KMnO_4$,Sulphur etc	1	5.3	15.8
Kanamycin, sulfate, melafex, fungi stop, water life protozin, $KMnO_4$, potassium permanganate (used for all bacterial, fungal, diseases).	1	5.3	21.1
Kanamycin, copper sulphate	1	5.3	26.3
$KMnO_4$,(for fungal disease), tetramycin (for bacterial disease)	1	5.3	31.6
$KMnO_4$, pestified	1	5.3	36.8
$KMnO_4$, neomycin sulphate, myxazin etc	1	5.3	42.1
Sodium bicarbonate, $KMnO_4$	2	10.5	52.6
Oxytetraxin, sodium bicarbonate	1	5.3	57.9
Salt, calcium carbonate	1	5.3	63.2
Calcium carbonate	1	5.3	68.4
Spinki, salt	1	5.3	73.7
Salt, sodium carbonate, spinki	1	5.3	78.9
Copper, sulfate, potassium carbonate	1	5.3	84.2
Kanamycin, sulphate	1	5.3	89.5
Copper and sodium	1	5.3	94.7
Copper and calcium sulphate	1	5.3	100.0
Total	19	100.0	
Mean 9.4737	Std. Deviation		± 5.18940

5.3% shows the minimum percentage of mature fish.

3.11. Types of feed used for fingerlings and adult fish

In most hatcheries, the feeding mechanisms of Fingerlings and Adults fish are different. Different types of food for fingerlings and adults fish are used for better growth and production [25]. The same kind of food affects the growth of fish. In figure 3 the maximum percentage is 68.4%, showing that most hatcheries use a different type of feed for fingerlings and adults. The minimum percentage, which is 31.6%, shows that some hatcheries use the same feed for fingerlings and adult fish.

3.12. Use of water filtering devices

The aerator is used for the production of oxygen in the pond. Mostly use oxygen powder and tablets for a temporary solution while the natural oxygen is also produced by sunlight [26]. A water-filtering device is used in hatcheries because it cleans the water and increases the production activity of oxygen in the water. Therefore, it has the maximum percentage, i.e., 73.7% and 26.3%, showing the minimum percentage of water filtering devices in the study area (Figure 4)

3.13. Analysis of infected Fish

The infected fish is analysed by skin rashes, skin wounds, skin irritation, irritation, irregular movement, feeding pattern and abnormal body parts. Fish also rub their skin with soil, jump out or stick out from the pond, etc [27]. So every hatchery has its way of analysing the infected fish. Different ways can examine infected fish, but the most efficient way is that when fish don't eat feed, red rashes on their skin, and when they stick their head out of the water, Table 9 shows the maximum percentage of infected fish, which is 10.5%. In comparison, 5.3% shows the minimum percentage of infected fish.

3.14. Types of medication used by the owner

Different types of medicines are used in hatcheries. Some hatcheries use medication according to disease, while some use a single treatment for every kind of disease due to lack of knowledge about diseases [28]. The preferable combination used as a medicine in the study area, was Sodium bicarbonate and $KMnO_4$ which shows a maximum percentage (10.5%) as shown in Table 14 which is used for bacterial and fungal diseases, and 5.3% shows the minimum percentage of other medications, i.e., hydrogen peroxide, kanamycin, sulphate, fungi stop, sodium, copper, etc. The mean and standard deviation of the data are 9.47 and ±5.18, respectively (table 10).

4. CONCLUSION

Fish suffer from different diseases as they can carry various pathogens and parasites. Pathogens that can cause fish diseases include viral infections, bacteria, fungi, protozoa, etc. Parasites that thrive and spread relatively quickly in recirculating systems include *Trichodina, Ichthyophthriasis, Costiasis, Epistysis* (red sore disease), *Myxosporidians* infestation. Bacteria that seem to increase recirculating systems have *Streptococcus* spp. and *Flavobacterium columnare* (Columnaris disease) and tail and fin-rot disease. Common fish diseases include gill disease, fungal infections, white spot disease, and swim bladder disease etc. It is observed that the disturbance in the hatchery is caused by different types of diseases, i.e., fungal and bacterial. But the leading and common cause in hatcheries of D. I. Khan is water pH disturbance. Water filtering devices are used in hatcheries because it cleans the water and enhances oxygen productivity in the water. It is also concluded that different ways can analyse infected fish, but the easiest way is that, when fish is not taking food, the appearance of red rashes on their skin and when they stick their head out of the water. Sodium bicarbonate and KMnO4 are preferable medicines used for bacterial and fungal diseases in Dera Ismail Khan fish hatcheries compared to other medications, i.e., hydrogen peroxide, kanamycin, sulpahte, fungi stop, sodium, copper, etc.

5. ACKNOWLEDGEMENT

6. CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

7. SOURCE/S OF FUNDING

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