Microbiological Evaluation of Surimi Product Processed from Marine Fish of Karachi Coast, Northern Arabian Sea

Waseem Ahmed Mangi*, Samina Parveen and Hina Mansoor

Department of Microbiology, University of Karachi -Karachi Pakistan

Abstract: The fish provisions manufacturing industries is demanding to produce diversification of foodstuffs from repercussion or less valuable fishes in response to increasing consumer nutritional requirements on the globe. Surimi is the one of the most important processed seafood having valuable and predominant protein content. Surimi is perishable, and when it rots, it has a strong odor and a bad taste. Degradation is due to enzymatic autolytic spoilage, fat oxidation, microbiological decay, or a mixture of these factors. The most stern seafood security affairs leading to potentially contaminated products relate to microorganisms, especially bacterial pathogens. For this purpose fish surimi product were collected for the microbiological evaluation, total plate count (TPC), total coliform, *Escherichia coli, Salmonella, Vibrio,* and *Staphylococcus aureus* from seabird fisheries Karachi during January to June 2020. The examined samples ranges varied between TPC (1.0 to 7.8) cfu/gm, TC (11 to 460 MPN/gm), FC (11 to 210 MPN/gm), *E.coli* (1.9 to 20), and *Staphylococcus aureus* (24 to 182 cfu/gm). The mean of TPC (4.6±2.12 cfu/gm), TC (120.2±107.29 MPN/gm), FC (67.03±28.02 MPN/gm), *E.coli* (9.1±5.94), *Staphylococcus aureus* (85.2±65.43 cfu/gm) were measured in (N=20) fish surimi product sample. *Salmonella sp.* and *Vibrio sp.* were absent in all examined samples.

Keywords: Surimi product, Microbiological analysis, Pathogens, Karachi coast.

INTRODUCTION

Fish and fish products are one of the main provenances of prominent constitution proteins hence consumed all over the world. Fish products are categorized into food and non-food products including fish oil, fish meal etc. and owing to various benefits these products well appreciated their consumption is increasing globally. According to the World Health Organization (WHO), mostly billions of communities rely on fish and fish products for their protein needs.

The demand of accessible and processed fish products have augmented tremendously because it is an affluent resource of protein with additionally containing iodine and zinc. Due to their high worldwide commerce volume, fish foodstuffs are at the vanguard of efforts to improve food safety and quality (Blaha and Gonçalves 2010). It is an vital source of elevated eminence proteins for people (Tidwell and Allan, 2001). Over the past ten years, the demand for as such premium quality protein has improved worldwide (Nielson *et al.,* 1994).

The sternest troubles with seafood security that could lead to contaminated goods are associated to microbiological infections, mainly bacterial pathogens. Fish value is the complicated perceptions that presuppose an extensive range of elements. For the user, these essentials capacity included for instance: safety, nutritional value, ease of access, convenience, and veracity, cleanness, consumption superiority, and the understandable physical uniqueness of the species dimension, and foodstuffs etc., (Abbas *et al.,* 2008).

Due to high demand, the seafood processing industry has strived to develop a wide variety of fish products while paying attention to product quality. One of the prepared fish products, surimi is a paste made from de-boned fish meat that has undergone many cleaning methods to eliminate lipids and other surplus constituent (Priyadarshini *et al.,* 2017). In order to manufacturing high-quality and upgrades and enriched seafood products, surimi is engaged employs since it has superior gel-forming capabilities (Moreno *et al.,* 2016). Due to the efficient removal of lipids and proteolytic enzymes during the washing process, the type and condition of washing processes during the producing of surimi have a major collision on the quality of surimi-based products (Priyadarshini *et al.,* 2017). Further factors as well as the type of fish, the quantity of protein, the pH, and the temperature may influence the consistency of surimi (Panpipat, Chaijan, & Benjakul, 2010). The food manufacturing industries are attempting to produce a variety of items from by-product or fewer expensive fishes while keeping their preferred sensory qualities due to the increasing dietary needs of customers (Ali *et al.,* 2017). One of the most significant types of processed seafood in the world is surimi, it is a staged product produced with machinery using crushed fish meat (Santana *et al.,* 2015). Tropical fish species account for more than 60% of all surimi formed worldwide, and this percentage is expanding as a result of escalating requirements. The

*Address correspondence to this author at the Department of Microbiology, University of Karachi -Karachi Pakistan; E-mail: waseemmangi198@gmail.com

consequence of fish surimi contains a significant amount of protein. In order to turn consequence into premium supplies like (gelatin, collagen, protein hydrolysates, peptides, and enzymes) that can be employed in useful foods, nourishing, and the medicinal business, effective methods must be developed (Jaziri *et al.,* 2021).

Surimi is perishable and loses its flavor and aroma when it rots. Enzymatic autolytic decay, chubby oxidation, microbiological decay, or combinations of these factors are the causes of degradation (Coton *et al.,* Xu *et al.,* 2011, 2010). According to Medina and Garrote (2002), surimi and its foodstuffs should be stored in frozen. The variety of low-value fish is expanding as new surimi-based products are developed or can be stored at room temperature with no losing nutrients. Four major pathogens have appeared as important contributors to human disease in studies of sea food-borne pathogens such as *Staphylococcus aureus, Listeria monocytogenes, Vibrio parahaemolyticus,* and *Salmonella spp.* (Feldhusen, 2000). According to Austin (2010), *V. parahaemolyticus* is a human disease those found as expected in marine environments and commonly inaccessible from an assortment of seafood. This pathogen is familiar as the most important cause of human 'stomach flu' linked with seafood utilization in the United States and is a general cause of food borne sickness in many Asian nations, as well as Taiwan, China, and Japan. 2002); Su and Liu (2007). The present study investigate the most signification microbiological detection in fresh surimi product. The aim of the present study is to evaluate the total plate count (TPC), total coliform, *Escherichia coli, Salmonella, Vibrio,* and *Staphylococcus aureus* in surimi fish product from M/s Sea Fresh Products, Karachi. The results of the study will help raising food safety concerns among the consumers.

MATERIALS AND METHODS

A total of 20 random samples of fish surimi product (Fresh) were collected for microbiological analysis during January to May 2022 from seabird fisheries Karachi. Each sample was stored in a separate, sterilized plastic bag and kept cold before being quickly transported to the lab for analysis under fully sterilized conditions. The obtained samples underwent microbiological testing to see whether they were secure and fit for human consumption. To determine the total plate count (TPC) for each sample, applied the spread plate method using Plate Count Agar. For determination of Aerobic plate counted recommended to the method of American Public Health Association (APHA, 2001). Total coliforms or fecal coliforms are enumeration methods that are based on lactose fermentation (APHA, 1992) and *Escherichia coli* were followed by Food and Drug Administration (FDA, 2002). Isolation and Enumeration of *Staphylococcus aureus* were method followed by Food and Drug Administration (FDA, 2001). Isolation and identification of Vibrio were followed the method of International Commission on Microbiological Specification for Foods (ICMSF, 1996).

RESULTS AND DISCUSSION

Table **1** shows the total coliform, fecal coliform, *E.coli*, *salmonella sp*, *vibiro sp*, and *Staphylococcus aureus* in fish surimi product collected from Karachi. The examined samples ranges varied between TPC (1.0 to 7.8) cfu/gm, TC (11 to 460 MPN/gm), FC (11 to 210 MPN/gm), *E.coli* (1.9 to 20), and *Staphylococcus aureus* (24 to 182 cfu/gm). *Salmonella sp.* and *Vibrio sp.* were absent in all examined samples. The mean of TPC (4.6±2.12 cfu/gm), TC (120.2±107.29 MPN/gm), FC (67.03±28.02 MPN/gm), *E.coli* (9.1±5.94), *Staphylococcus aureus* (85.2±65.43 cfu/gm) were measured. The highest (TPC) 7.8 cfu/gm were obtained in product 18 and lowest (1.0 cfu/gm) in product 8. The maximum TC (460 MPN/gm) were found in product 4 and lowest (11 MPN/gm) in product 14,15,16 and 17. Highest FC (210 MPN/gm) were obtained in product 10 and lowest (11 MPN/gm) in product 13, 14 and 15. Maximum *E.coli* (20 MPN/gm) were measured in product 2 and minimum (1.9 MPN/gm) in product 12. *S. aureus* were obtained highest (182 cfu/gm) in product 3 and lowest (24 cfu/gm) in product 1 (Table **1**; Figure **1**).

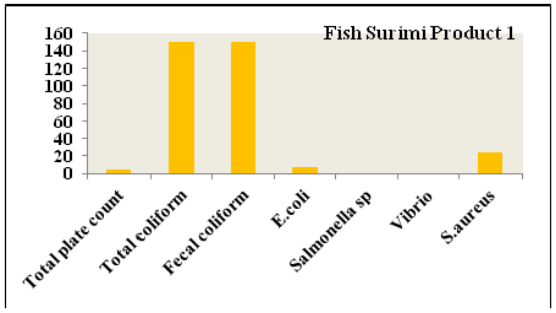
Edris *et al.,* (2017) reported microbiological assessment of various frozen and salty products of fish from Egyptian markets, the bacteriological analysis revealed that frozen *T. nilotica*, salted *M. cephalus*, and samples of sardine. Mean APC values of 4.80 0.16, 4.63 0.18, 2.35 0.18, and 2.70 0.13 (log10 cfu/g), in that order. Additionally, the coliform counts in the examined samples were 1.48 0.22, 2.19 0.19, 2.10 0.16, and 2.52 0.11, respectively, and the E. Fishery foodstuffs are imperative not only for their dietary value other than also for international trade because they aid many nations in acquiring foreign currency (Yagoub and Ahmed, 2003). Shewan J.M. (1962) reported that the total number of chitosan-coated or untreated shrimp samples had a maximum count of (APC 5.5 log

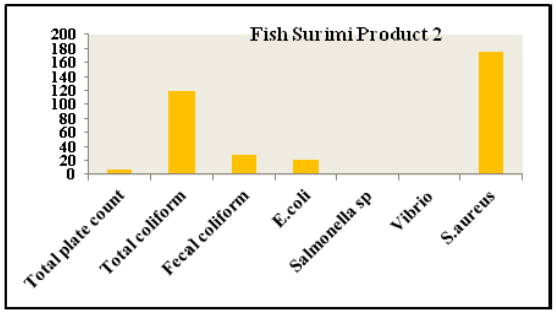
cfu/g), It implies that storing shrimp at low temperatures is advantageous. On the other hand, it has been demonstrated that gutting fish will increase shelf life since fewer bacterial populations will enter the fish during refrigeration. Thus all of these variables may affect the development and presence of bacteria in shrimp muscle.

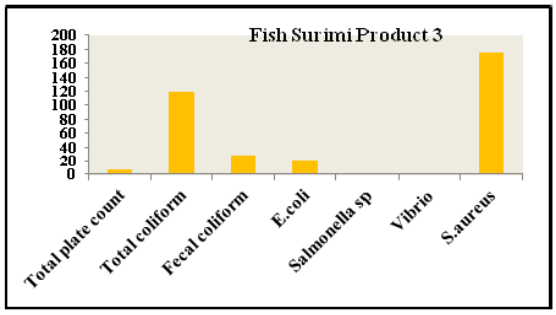
The presence of *S. arueus* in food indicates that it has been contaminated by food handlers' skin, mouth, or nose. Infectivity could be ascribed to equipment that has not been passably cleaned. Basti and others, 2006) established that the contagion of fish during imprison and ensuing insanitary treatment and dispensation led to the identification of the *S. aureus* genus as the mainly significant genus from highly-salted fish. We unspecified that the contagion of the fish through imprison and subsequent unsanitary handling and processing were the causes of the isolated *S. aureus* (Shena *et al.,* 2007). Inaccessible of *S. aureus* in fishery foodstuffs and industrial unit employees who process fish, this bacterium is not a

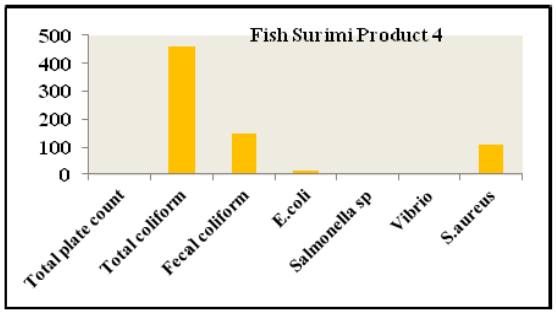
Table 1: Total Plate Count in Fish Surimi Product

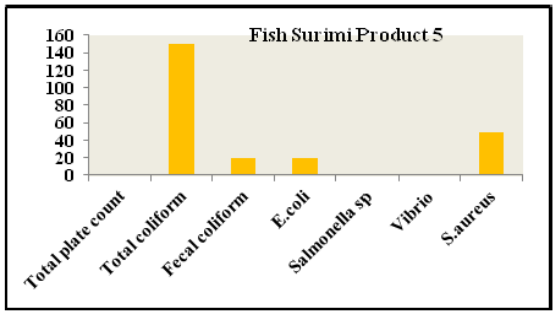
No of Samples	Total Plate Count cfu/gm	Total Coliform MPN/gm	Fecal Coliform MPN/gm	*E.coli* MPN/gm	*Salmonella sp.* 25/gm	*Vibrio sp.* 25/gm	*Staphylococcus aureus* cfu/gm
Temperature	**35 °C**	**35 °C**	**45.5 °C**	**35 °C**	**35 °C**	**35 °C**	**35 °C**
No. of samples	**20**	**20**	**20**	**20**	**20**	**20**	**20**
Minimum	1.0	11	11	1.9	Absent	Absent	24
Maximum	7.8	460	210	20	-	-	182
Mean	4.6	120.2	67.03	9.1	-	-	85.2
Standard deviation	2.12	107.29	28.02	5.94	-	-	65.43

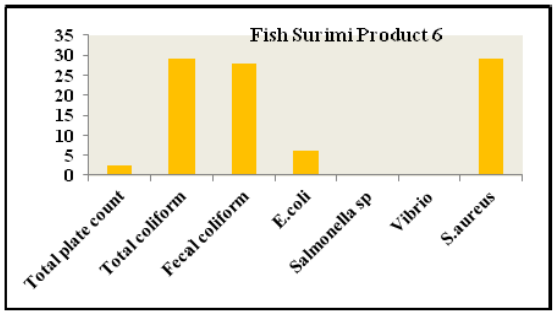


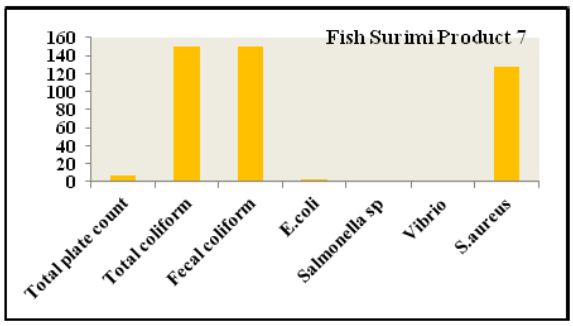


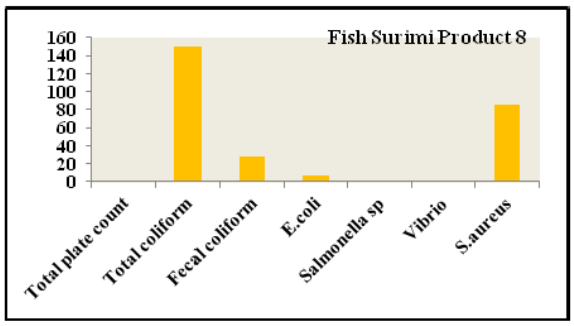


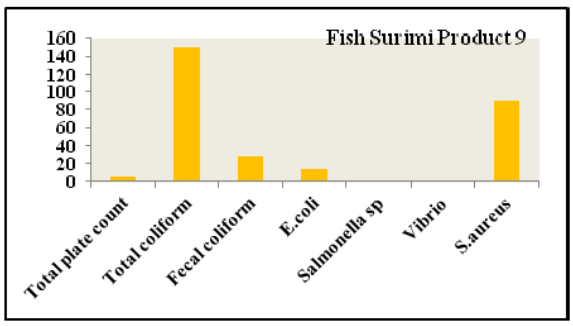


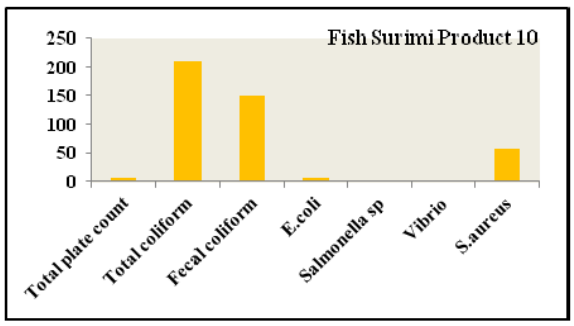


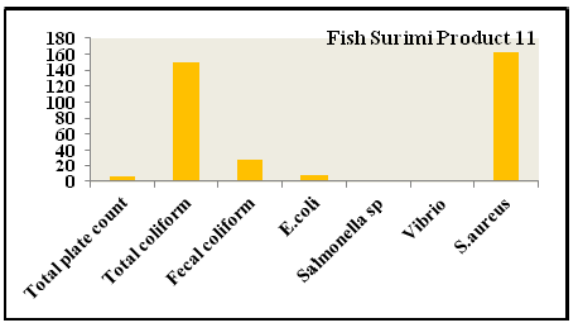


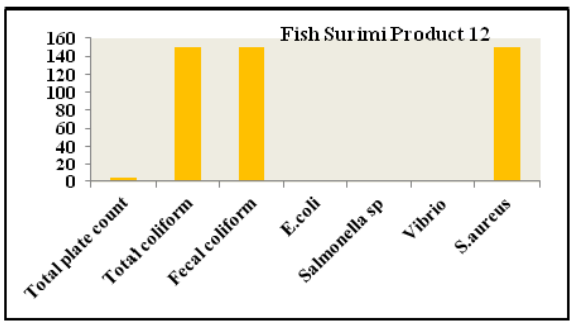

Fish Surimi Product 7
160
140
120
100
80
60
40
20
0
Total plate count
Total coliform
Fecal coliform
E.coli
Salmonella sp
Vibrio
S.aureus

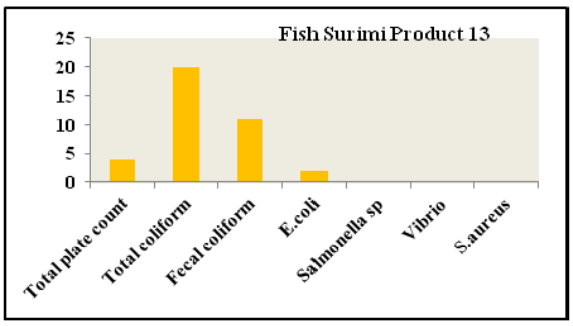

Fish Surimi Product 8
160
140
120
100
80
60
40
20
0
Total plate count
Total coliform
Fecal coliform
E.coli
Salmonella sp
Vibrio
S.aureus

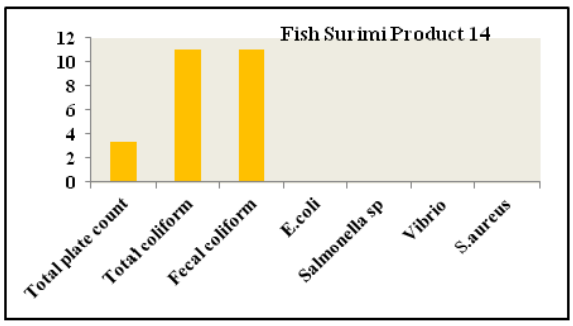

Fish Surimi Product 9
160
140
120
100
80
60
40
20
0
Total plate count
Total coliform
Fecal coliform
E.coli
Salmonella sp
Vibrio
S.aureus

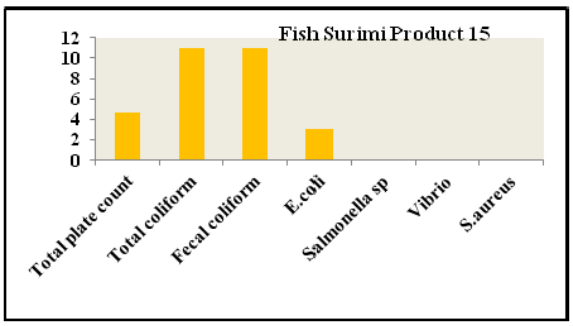

Fish Surimi Product 10
250
200
150
100
50
0
Total plate count
Total coliform
Fecal coliform
E.coli
Salmonella sp
Vibrio
S.aureus

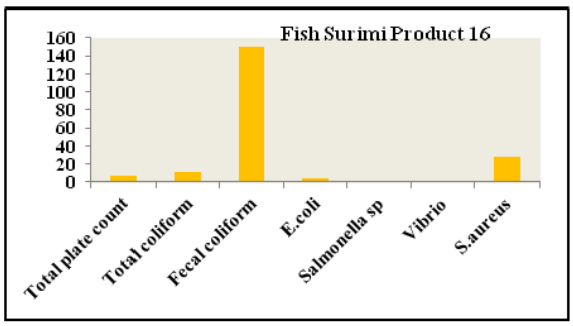

Fish Surimi Product 11
180
160
140
120
100
80
60
40
20
0
Total plate count
Total coliform
Fecal coliform
E.coli
Salmonella sp
Vibrio
S.aureus


Fish Surimi Product 12
160
140
120
100
80
60
40
20
0
Total plate count
Total coliform
Fecal coliform
E.coli
Salmonella sp
Vibrio
S.aureus


Fish Surimi Product 13
25
20
15
10
5
0
Total plate count
Total coliform
Fecal coliform
E.coli
Salmonella sp
Vibrio
S.aureus


Fish Surimi Product 14
12
10
8
6
4
2
0
Total plate count
Total coliform
Fecal coliform
E.coli
Salmonella sp
Vibrio
S.aureus


Fish Surimi Product 15
12
10
8
6
4
2
0
Total plate count
Total coliform
Fecal coliform
E.coli
Salmonella sp
Vibrio
S.aureus


Fish Surimi Product 16
160
140
120
100
80
60
40
20
0
Total plate count
Total coliform
Fecal coliform
E.coli
Salmonella sp
Vibrio
S.aureus

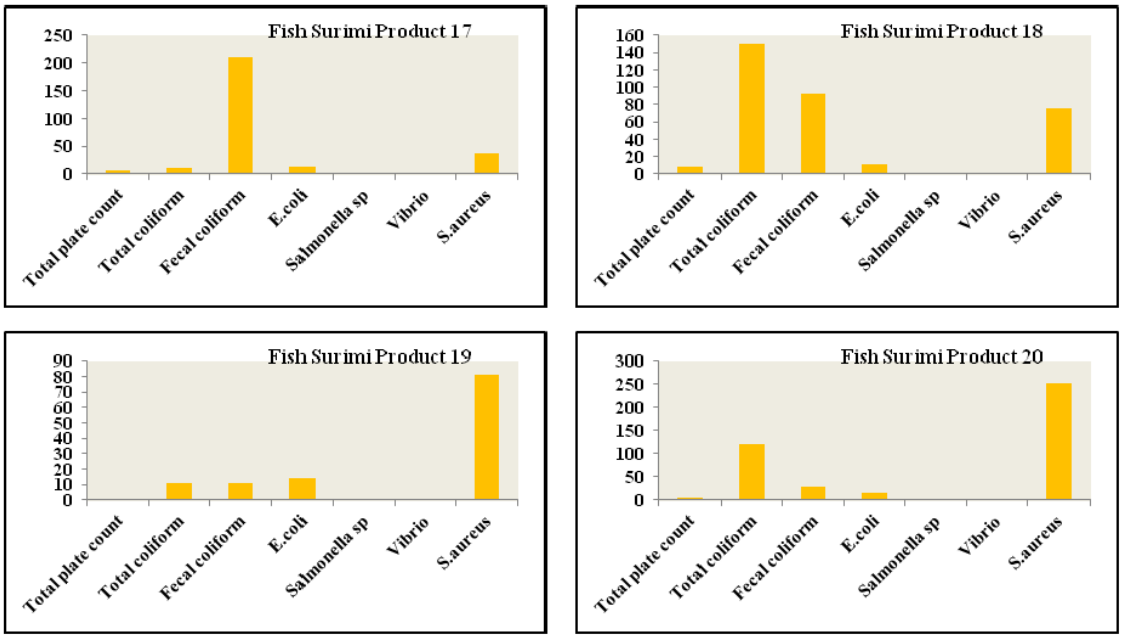


Figure 1: Individuals mean values of (TPC, TC, FC, E.coli, *Salmonella sp. Vibrio sp,* and *Staphylococcus aureus* in all fish surimi product samples).

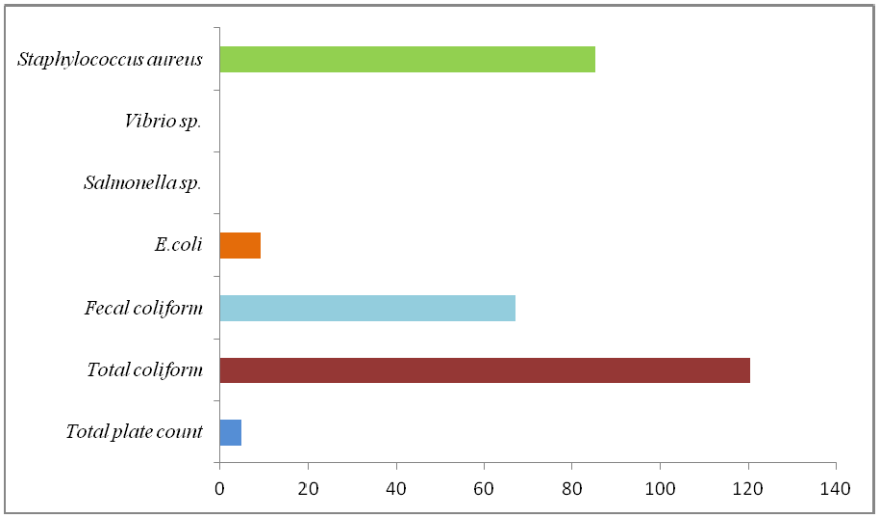


Figure 2: Total mean values of (TPC, TC, FC, E.coli, *Salmonella sp. Vibrio sp, and Staphylococcus aureus* in fish surimi product samples).

significant issue in fishery products in small amount; however, if the manufactured is handled not carefully during dispensation, resultant in high grow (>1105cfu/g), food poisoning may occur (Varnam and Evans, 2001; Vishwanath and others, 1998). Edris *et al.*, stated that a plate count greater than 1x103 cfu/g *S. auris* is the greatest suitable absorption rate for fish of sardines. As a result, consumers may be at risk of *S. aureus* intoxication if they consume such products. Better outcomes were achieved that found *V. parahaemolyticus* isolated from 5% of the marine fish samples examined (Baffone *et al.,* 2000). The halophilic bacterium *V. parahaemolyticus* is able of originate food and waterborne gastroenteritis, lesion infections, and septicemia in peoples. The isolation of *V. parahaemolyticus* from these marine fish samples could primarily be qualified to sewage pollution. It is common perform to isolate the microorganism from an assortment of raw seafood and shellfish. Heightened gastroenteritis, diarrhea, headache, vomiting etc., (Caburlotto *et al.,* 2008) may result that the consumption of seafood that has been undercooked or

raw and is contaminated with *V. parahaemolyticus*. The findings of this investigation will be beneficial to future biologists.

REFERENCES

[1] Abbas KA, Mohamed A, Jamilah B and Ebrahimian M. A review on correlations between fish freshness and pH during cold storage. Am. J. Biochem. Biotechnol 2008; 4(4): 416-421. https://doi.org/10.3844/ajbbsp.2008.416.421

[2] Ali HA, Mansour EH, E-lBedawey AEFA & Osheba AS. Evaluation of tilapia fish burgers as affected by different replacement levels of mashed pumpkin or mashed potato. Journal of the Saudi Society of Agricultural Sciences 2017; 18, 127-132. https://doi.org/10.1016/j.jssas.2017.01.003

[3] American Public Health Association APHA 2001. Compendium of methods for the microbiological examination of Food. 4th ed., Washington, D.C

[4] American Public Health Association. 1992. Compendium of Methods for the Microbiological Examination of Foods, 3rd ed. APHA, Washington, DC.

[5] Austin B. Vibrios as causal agents of zoonoses. Vet Microbiol 2010; 140: 310-317. https://doi.org/10.1016/j.vetmic.2009.03.015

[6] Basti AA, Misaghi A and Salehi TZ. (2006). Bacterial pathogens in fresh, smoked and salted Iranian fish. Food Control. 17(3): 183-188. https://doi.org/10.1016/j.foodcont.2004.10.001

[7] Blaha F and Gonçalves AA. (2010). Blaha, F. &.Gonçalves, A.A. Cold chain in seafood industry. In: Larsen, M.E. (ed.), Refrigeration: Theory, Technology and Applications. 287-367.

[8] Baffone W, Pianetti A, Bruscolini F, Barbieri E and Citterio B. Occurrence and expression of virulence-related properties of Vibrio species isolated from widely consumed seafood products. InternationalJournal of Food Microbiol 2000; 54: 9-18. https://doi.org/10.1016/S0168-1605(99)00189-0

[9] Caburlotto G, Ghidin V, Gennari M, Tafi M and Lleo M. 2008. Isolation of Vibrio parahaemolyticus pandemic strain from a marine water sample obtained in the northern Adriatic. Eurosurveillance, 13: 1-3. https://doi.org/10.2807/ese.13.11.08068-en

[10] Coton M, Denis C, Cadot P, Coton E. (2011). Biodiversity and characterization of aerobic spore-forming bacteria in surimi seafood products Food Microbiology, 28, 252 p. https://doi.org/10.1016/j.fm.2010.03.017

[11] Edris MA. Hassanien FS, Shaltout FAE, Baba AH, Adel NM. Microbiological evaluation of some frozen and salted fish products in Egyptian markets, Benha veterinary medical journal 2017; 33(2): 317-328. https://doi.org/10.21608/bvmj.2017.30493

[12] Feldhusen F. The role of seafood in bacterial food-borne diseases. Microbes Infect 2000; 2: 1651-1660. https://doi.org/10.1016/S1286-4579(00)01321-6

[13] FDA, Food and Drug Administration. (2001). U. S. Department of health and human services. Public Health Service. Food and Drug Administration. College Park, MD 20740.

[14] Howell NK. (2004). The chemistry of quality enhancement in low-value fish Quality of Fresh and Processed Foods, 542: pp. 135-145. https://doi.org/10.1007/978-1-4419-9090-7_8

[15] International Commission on Microbiological Specification for Foods (ICMSF) (1996). Vibrio parahaemolyticus. Microorganisms in Foods. Characteristics of Microbial Pathogens Blackie Academic & Professional, London. pp. 426-435.

[16] Jaksic S, Uhitil S, Petrak T, Bazulic D, and Karolyi LG. Occurrence of Vibrio spp. in sea fish, shrimp and bivalve mollusks harvested from Adriatic Sea. Food Cont 2002; 13: 491-493. https://doi.org/10.1016/S0956-7135(02)00027-0

[17] Jaziri AA, Shapawi R, Mohd Mokhtar RA, Md. WN, Noordin and Huda N. (2021) Tropical Marine Fish Surimi By-products: Utilisation and Potential as Functional Food Application, Food Reviews International. https://doi.org/10.1080/87559129.2021.2012794

[18] Martin-Sanchez AM, Navarro C, Perez-Alvarez JA, Kuri V. (2009). Alternatives for efficient and sustainable production of surimi: a review Comprehensive Reviews in Food Science and Food Safety, 8, pp. 359-374. https://doi.org/10.1111/j.1541-4337.2009.00087.x

[19] Moon JH, Yoon WB & Park JW. (2017). Assessing the textural properties of Pacific whiting and Alaska pollock surimi gels prepared with carrot under various heating rates. Food Bioscience, 20, 12-18. https://doi.org/10.1016/j.fbio.2017.07.008

[20] Moreno HM, Herranz B, Perez-Mateos M, Sanchez-Alonso I, Borderias AJ. (2016). New alternatives in seafood restructured products Critical Reviews in Food Science and Nutrition, 56 (2); pp. 237-248. https://doi.org/10.1080/10408398.2012.719942

[21] Moazzam M. (2012). Status report on by catch of tuna gillnets operations in Pakistan, Eighth session of the Working Party on Ecosystem and By Catch (WPEB), Cape Town South Africa.

[22] Nazir K, Yongtong Mu, Hussain K, Kalhoro MA, Kartika S & Mohsin M. A Study on the Assessment of Fisheries Resources in Pakistan and its Potential to Support Marine Economy, Indian Journal of Geo-Marine Sciences 2016; 45(9): 1181-1187.

[23] Pascoe S. Measuring Capacity in Fisheries (2003). FAO Fisheries Technical Paper, 445.

[24] Panpipat W, Chaijan M, Benjakul S. Gel properties of croaker-mackerel surimi blend, Food Chemistry 2010; 122(4): 1122-1128. https://doi.org/10.1016/j.foodchem.2010.03.096

[25] Priyadarshini B, Xavier KM, Nayak BB, Dhanapal K & Balange AK. Instrumental quality attributes of single washed surimi gels of tilapia: Effect of different washing media. LWT-Food Science and Technology 2017; 86: 385-392. https://doi.org/10.1016/j.lwt.2017.08.022

[26] Santana P, Huda N, Yang T. Physicochemical Properties and Sensory Characteristics of Sausage Formulated Powder. J. Food Sci. Technol 2015; 52(3): 1507-1515. https://doi.org/10.1007/s13197-013-1145-1

[27] Shena SS and Sanjeev S. Prevalence of enterotoxigenic Staphylococcus aureus in fishery products and fish processing factory workers, Food Control 2007; 18(12): 1565-1568. https://doi.org/10.1016/j.foodcont.2006.12.007

[28] Shewan JM. The bacteriology of fresh and spoiling fish and some related chemical changes. Recent Adv. Food Sci 1962; 1: 167-193.

[29] Su YC and Liu C. Vibrio parahaemolyticus: a concern of seafood safety. Food Microbiol 2007; 24: 549-558. https://doi.org/10.1016/j.fm.2007.01.005

[30] Tidwell JH and Allan GL. Fish as food: Aquaculture's contribution. Ecological and economic impacts and contributions of fish farming and capture fisheries EMBO Reports 2001; 2(11): 958-63. https://doi.org/10.1093/embo-reports/kve236

[31] Vanderzant C and Splittstoesser DF. 2008. American Public Health Association, Compendium of methods for the

microbiological examination. 4th ed. Washington:, PP.105-119, 325-367, 371-415, and 637-658.

[32] Varnam AH and Evans MG. 2001. Food borne pathegens, wolf publications, London, pp: 157-83.

[33] Vishwanath W, Lillabati H and Bijen M. Biochemical, nutritional and microbiological quality of fresh and smoked mudeel fish monopterus albus, Food Chemistry 1998; 6(12): 153-157. https://doi.org/10.1016/S0308-8146(97)00108-8

[34] Xu YS, Xia WS, Yang F, Kim JM, Nie XH. Effect of fermentation temperature on the microbial and physicochemical properties of silver carp sausages inoculated with Pediococcus pentosaceus, Food Chemistry, 2010; 118: 512-518. https://doi.org/10.1016/j.foodchem.2009.05.008

[35] Yin T, & Park JW. Optimum processing conditions for slowly heated surimi seafood using protease-laden Pacific whiting surimi. LWT-Food Science and Technology, 2015; 63(1): 490-496. https://doi.org/10.1016/j.lwt.2015.02.033

[36] Yagoub SO and Ahmed TM. Pathogenic Microorganisms in fresh water samples collected from Khartoum central market. Sudan J. of Veterinary Science and Animal Husbandry 2003; 43(1-2): 32-37.

Received on 08-02-2023 Accepted on 16-02-2023 Published on 23-02-2023