



Research Article

Effect of Cooking Methods on Nutritional and Quality Characteristics of Fish

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Abstract | The study was carried out during the 2019-20 at laboratory of Institute of Food Sciences and Technology, Sindh Agriculture University, Tandojam. The treatments included in the study were Grilled fish T₁, Fried fish T₂, Microwave T₃ = respectively, and treatment were arranged in CRD with the repeats. The results revealed that the cooking in methods were significantly varied (LSD<0.05) for different parameters. The fish cooked in microwave resulted average value of moisture 65.03%, titratable acidity 1.78%, pH value 6.26, protein 24.07%, fat 3.76%. Whereas, the fried fish resulted moisture 62.16%, titratable acidity 1.39%, pH value 5.96, protein 21.11%, fat 5.93%. The fish grilled resulted in moisture 60.19%, titratable acidity 1.32%, pH value 5.89, protein 20.28%, and fat 4.13%. According to the sensory evaluation the result of microwave method were found significantly high than other methods with score of all sensorial parameters i.e. color (7.33), flavor (7.66), texture (8.00), taste (7.66), aroma (7.33) and overall acceptability (8.00). Whereas, the lowest sensory score was recorded in fish with grilled method of cooking and scored (6.00), (5.66), (5.66), (5.33), (5.00), (6.33) in color, flavor, texture, taste, aroma and overall acceptability, respectively.

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Introduction

Fish is one of the major animal protein foods available in the tropics. This has made fishery an important aspect of study. According to (Aberoumand, 2014; El-Lahamy *et al.*, 2019) fish constitutes 40% of animal protein intake. fish is one of the most perishable and in the tropical climate of most developing countries it was come unfit for human consumption within about one day of capture, unless it is subjected to some form of processing (Gladyshev *et al.*, 1999).

The principal of fish components are water, protein, lipids and carbohydrates (Ames, 1991), while the

followings minerals are commonly found in fish sodium, potassium, calcium, magnesium, phosphorus, sulphur, iron, chlorine, silicon, manganese, zinc, copper, arsenic and iodine (Latimer, 2019). the environment and season (Silva and Chamul, 2000; Głuchowski *et al.*, 2019). Processors have direct interest in the proximate composition of fish in order to know the nature of the raw material before chilling, freezing, smoking or canning can be correctly applied.

Fish is one of the most complete foods, nutrient quality and quantity an average 100g portion provides more than 50% of the recommended daily protein intake, between 10% and 20% of minerals, vitamins

A, D, and E (Perea *et al.*, 2008; Bastías *et al.*, 2017).

Materials and Methods

Experimental design = Completely Randomized Design (CRD)

Treatments = 03 (T₁= Grilled fish, T₂= fried fish, T₃ = microwave)

Replication = 03

Results and Discussion

the study was carried out during of 2018-19 at laboratory of Institute of Food Sciences and Technology, Sindh Agriculture University, Tandojam. Treatments included: T₁= Grilled fish, T₂= fried fish, T₃ = microwave. Some parameters of economic importance were studied which included: Moisture (%), Titratable acidity (%), pH value, protein (%), fat (%), color, flavor, texture, taste, aroma and overall acceptability. The data on the above parameters are presented in Tables 1-11.

Table 1: Moisture (%) of fish under different cooking methods.

| Treatments | RI | RII | RIII | Mean |
|-------------------------------|--------|-------|-------|---------|
| T ₁ = Grilled fish | 60.12 | 60.25 | 60.20 | 60.19 C |
| T ₂ = Fried fish | 62.80 | 62.75 | 62.90 | 62.81 B |
| T ₃ = Microwave | 64.80 | 65.20 | 65.10 | 65.03 A |
| S.E.± | 0.0964 | | | |
| LSD 0.05 | 0.2676 | | | |

Table 2: Titratable acidity (%) of fish under different cooking methods.

| Treatments | RI | RII | RIII | Mean |
|-------------------------------|--------|------|------|--------|
| T ₁ = Grilled fish | 1.30 | 1.35 | 1.33 | 1.32 C |
| T ₂ = Fried fish | 1.36 | 1.39 | 1.42 | 1.39 B |
| T ₃ = Microwave | 1.75 | 1.82 | 1.79 | 1.78 A |
| S.E.± | 0.0136 | | | |
| LSD 0.05 | 0.0378 | | | |

Table 3: pH value of fish under different cooking methods.

| Treatments | RI | RII | RIII | Mean |
|-------------------------------|--------|------|------|--------|
| T ₁ = Grilled fish | 5.91 | 5.87 | 5.89 | 5.89 C |
| T ₂ = Fried fish | 5.94 | 5.96 | 5.98 | 5.96 B |
| T ₃ = Microwave | 6.28 | 6.24 | 6.26 | 6.26 A |
| S.E.± | 0.0163 | | | |
| LSD 0.05 | 0.0453 | | | |

Table 4: Protein (%) of fish under different cooking methods.

| Treatments | RI | RII | RIII | Mean |
|-------------------------------|--------|-------|-------|---------|
| T ₁ = Grilled fish | 20.20 | 20.35 | 20.30 | 20.28 C |
| T ₂ = Fried fish | 24.05 | 24.08 | 24.10 | 24.11 B |
| T ₃ = Microwave | 21.08 | 21.10 | 21.15 | 21.15 A |
| S.E.± | 0.0307 | | | |
| LSD 0.05 | 0.0853 | | | |

Table 5: Fat (%) of fish under different cooking methods.

| Treatments | RI | RII | RIII | Mean |
|-------------------------------|--------|------|------|--------|
| T ₁ = Grilled fish | 4.05 | 4.15 | 4.20 | 4.13 B |
| T ₂ = Fried fish | 5.80 | 5.90 | 6.10 | 5.93 A |
| T ₃ = Microwave | 3.66 | 3.76 | 3.87 | 3.76 C |
| S.E.± | 0.0356 | | | |
| LSD 0.05 | 0.0988 | | | |

Table 6: Color of fish under different cooking methods.

| Treatments | RI | RII | RIII | Mean |
|-------------------------------|--------|------|------|--------|
| T ₁ = Grilled fish | 6.00 | 6.00 | 6.00 | 6.00 C |
| T ₂ = Fried fish | 6.00 | 7.00 | 7.00 | 6.66 B |
| T ₃ = Microwave | 8.00 | 7.00 | 7.00 | 7.33 A |
| S.E.± | 0.0707 | | | |
| LSD 0.05 | 0.1730 | | | |

Table 7: Flavor of fish under different cooking methods.

| Treatments | RI | RII | RIII | Mean |
|-------------------------------|--------|------|------|--------|
| T ₁ = Grilled fish | 6.00 | 6.00 | 5.00 | 5.66C |
| T ₂ = Fried fish | 7.00 | 6.00 | 5.00 | 6.00 B |
| T ₃ = Microwave | 8.00 | 8.00 | 7.00 | 7.66 A |
| S.E.± | 0.0408 | | | |
| LSD 0.05 | 0.0999 | | | |

Table 8: Texture of fish under different cooking methods.

| Treatments | RI | RII | RIII | Mean |
|-------------------------------|--------|------|------|--------|
| T ₁ = Grilled fish | 5.00 | 6.00 | 6.00 | 5.66C |
| T ₂ = Fried fish | 6.00 | 6.00 | 7.00 | 6.33 B |
| T ₃ = Microwave | 8.00 | 8.00 | 8.00 | 8.00 A |
| S.E.± | 0.0408 | | | |
| LSD 0.05 | 0.0999 | | | |

Table 9: Taste of fish under different cooking methods.

| Treatments | RI | RII | RIII | Mean |
|-------------------------------|--------|------|------|--------|
| T ₁ = Grilled fish | 5.00 | 5.00 | 6.00 | 5.33 C |
| T ₂ = Fried fish | 6.00 | 7.00 | 7.00 | 6.66 B |
| T ₃ = Microwave | 8.00 | 8.00 | 7.00 | 7.66 A |
| S.E.± | 0.0408 | | | |
| LSD 0.05 | 0.0999 | | | |

Table 10: *Aroma of fish under different cooking methods.*

| Treatments | RI | RII | RIII | Mean |
|-------------------------------|--------|------|------|--------|
| T ₁ = Grilled fish | 5.00 | 5.00 | 6.00 | 5.00 C |
| T ₂ = Fried fish | 6.00 | 6.00 | 7.00 | 6.33 B |
| T ₃ = Microwave | 8.00 | 7.00 | 7.00 | 7.33 A |
| S.E.± | 0.0491 | | | |
| LSD 0.05 | 0.1201 | | | |

Table 11: *Overall acceptability of fish under different cooking methods.*

| Treatments | RI | RII | RIII | Mean |
|-------------------------------|--------|------|------|--------|
| T ₁ = Grilled fish | 6.00 | 6.00 | 7.00 | 6.33 C |
| T ₂ = Fried fish | 7.00 | 7.00 | 6.00 | 6.66 B |
| T ₃ = Microwave | 8.00 | 8.00 | 8.00 | 8.00 A |
| S.E.± | 0.0816 | | | |
| LSD 0.05 | 0.1998 | | | |

Moisture (%)

Moisture is the major constituent of the fish. It is evident from the results that the maximum fish moisture 65.03% was found in the fish cooked under microwave, followed by fried fish with 62.81% moisture. However, the minimum moisture (60.19%) was observed with grilled fish. It was recorded that microwave cooked fish has high moisture (65.03%) content other than fried and grilled fish. The LSD test demonstrated that the differences in moisture (%) different cooked methods were found significant (P<0.05).

Titratable acidity (%)

maximum fish titratable acidity (1.78%) under microwave, fried 1.39%, (1.32%) grilled fish. The result was found in microwave fish of titratable acidity (1.78%) is higher than fried and grilled fish. The LSD test demonstrated that the differences in titratable acidity (%) different cooked methods were significant (P<0.05).

pH value

maximum fish pH value (6.26) under microwave, fried fish with (5.96) pH value. However, the minimum pH value (5.89) grilled fish. In this treatment of cooking methods microwave fish pH value (6.26) was observed. The LSD test demonstrated that the differences in pH value different cooked methods were significant (P<0.05).

Protein (%)

The protein (%) under following tables Grilled fish, fried fish and microwave and the results are reported in Table 4 and their ANOVA protein was significantly (P<0.05) influenced by cooked methods.

Fat (%)

Maximum fish fat (5.93%) under fried, grilled fish with 4.13% fat. However, the minimum fat (3.76%) was observed with microwave fish. In this research of different cooking methods for fat determination the high fat (5.93%) was noted in fried fish then grilled and microwave fish. The LSD test demonstrated that the differences in fat (%) different cooked methods were significant (P<0.05).

Color

maximum fish color (8.25) under microwave, fried fish with 7.40 color. However, the minimum color (6.60) grilled fish. The LSD test demonstrated that the differences in color different cooked methods were significant (P<0.05).

Flavor

maximum fish flavor (8.45) when the fish cooked under microwave, followed by fried fish with 7.25 flavor. However, the minimum flavor (6.50) grilled fish. It was found in microwave was better method for fish cooked flavor. The LSD test demonstrated that the differences in flavor different cooked methods were non-significant (P>0.05).

Texture

It is evident maximum fish texture (8.35) when the fish cooked under microwave, followed by fried fish with 7.45 texture. However, the minimum texture (6.45) was observed with grilled fish. It was found that microwave was optimum for fish cooked so far the texture. The LSD test demonstrated that the differences in texture different cooked methods were non-significant (P>0.05).

Taste

It is evident maximum fish taste (8.40) when the fish cooked under microwave, followed by fried fish with 7.30 taste. However, the minimum taste (6.55) was observed with grilled fish. It was observed that microwave was cooking method on fish is better taste. The LSD test demonstrated that the differences in taste different cooked methods were non-significant (P>0.05).

Aroma

It is evident maximum fish aroma (8.25) when the fish cooked under microwave, followed by fried fish with 7.31 aroma. However, the minimum aroma (6.55) was observed with grilled fish. It was found in that microwave fish cooked was good aroma. The LSD test demonstrated that the differences in aroma different cooked methods were non-significant ($P > 0.05$).

Conclusions and Recommendations

Microwave cooking method in comparison of fried and grilled cooking methods. While comparing the fried and grilled cooked fish, the results indicated that microwave cooked fish had considerable affect on the proximate composition and microwave cooking were found to be the best cooking methods for healthy eating. While grilled sample was healthier than those fried sample baked fish can be recommended for healthy eating because of harder texture and lower sensorial acceptability of grilled samples. Microwave cooked fish is one of the most effective methods of preparing fish to minimize nutrient losses.

Novelty Statement

This is baseline study and information about method, nutritional, quality and characteristics of fish.

Author's Contribution

Salman Ali, Riaz Ali Rind and Majid Ali: Conceived the idea, data collection, data entry in SPSS and analysis.

Ayaz Ali and Shagufta Naz: Wrote the manuscript.

Zulfiqar Ali Mastoi: Did SPSS analysis and concluded the study.

Muhammad Shakir and Rashid Ahmed Qaim Khani: Provided technical input at every step and did overall management.

Conflict of interest

The authors have declared no conflict of interest.

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