International Journal of Zoology Studies
ISSN: 2455-7269
Impact Factor: RJIF 5.14
www.zoologyjournals.com
Volume 2; Issue 6; November 2017; Page No. 182-185

Comparative quality assessment of labeo rohita muscle subjected to preservation by two different drying techniques

[1] Roopma Gandotra, [*2] Sunakshi Sharma, [3] Vaini Gupta
[1] Professor, Department of Zoology, University of Jammu, Jammu and Kashmir, India
[2] M.Phil Scholar, Department of Zoology, University of Jammu, Jammu and Kashmir, India
[3] Ph.D Scholar, Department of Zoology, University of Jammu, Jammu and Kashmir, India

Abstract
The present study was intended to examine the proximate and microbial profile of raw *Labeo rohita* muscle dried under two different conditions viz. sun drying (SD) and oven drying (OD) followed by storage at room temperature. Quality assessment of dried muscle was done for a period of 49 days. Results revealed that there was a significant percental decrease ($p \leq 0.05$) of 6.97%, 27.00%, 10.92% in protein, lipid and ash content, respectively in SD sample where as in OD sample, it was 6.08%, 18.27% and 9.16% respectively. However, the moisture content increased with increase in storage period in both the samples. The microbial load increased gradually throughout the storage period. In SD sample, Total Plate Count (TPC) increased from 1.91±0.01 log cfu/g on day 0 to 6.35±0.07 log cfu/g on day 49 where as the increase was from 1.04±0.04 log cfu/g on day 0 to 4.8±0.2 log cfu/g on day 49 in OD sample. The study revealed that in SD sample TPC was within the permissible limit (6 log cfu/g) on 42nd day while TPC of OD sample remained within the permissible limit till the last day i.e. 49th day of room temperature storage thus making it recommendable for human consumption even after this time period of 49 days.

Keywords: sun drying, oven drying, proximate composition, microbial profile, *labeo rohita*

1. Introduction
Fishes are known to provide high contents of important constituents for the human diet such as readily-digestive proteins, lipid-soluble vitamins (A, D, E, K), microelements and polyunsaturated fatty acids which make it a highly recommended diet. Recently fish consumption has also been linked to increased grey matter in brain thus protecting it from age related cognitive decline. Despite its high nutritional value, fish is highly susceptible to microbial and chemical deterioration which results in considerable losses in its quality before consumption. This makes it quite necessary to preserve the fish by combination of various techniques.

Traditional fish processing, such as salting/brining, drying, smoking, allow better preservation and storage, and increase fish availability to the consumers (Mohamed and Ahmed, 2016) [15]. Salting is a traditional method of fish preservation throughout the world. Salting is often used in combination with smoking and drying. Fish drying aids by removing moisture content of non-aqueous material to such a level that insufficient water remains to support the growth of microorganisms and chemical degradation is also checked. Dried fish is widely available in the market and many people prefer to relish the taste of this traditional food. Further different drying methods have different effects on the nutritional composition of fish.

Hence the present study was carried out with the objective to determine the proximate and microbial profile of raw *Labeo rohita* fish dried under two different conditions viz. sun drying and oven drying.

2. Materials and Methods
2.1 Collection and Sample processing
Fresh samples of *Labeo rohita* were purchased from local market of Jammu city. They were immediately brought to the laboratory in polythene bags with crushed ice. The fish was degutted, washed with large amount of water and then subjected to filleting. These raw fillets were subjected to dry salting in a salt to fish ratio of 1:3 for 24 hrs. The salted fish was then dried by two different methods:

a) **Sun drying:** Half of the salted samples were dried under bright sun light in open air by placing them on an elevated rack raised about 1 m above the floor.
b) **Oven drying:** The remaining half of the salted samples was subjected to oven drying with a preliminary temperature of 40^{0}C for 1 hr. Then the temperature was increased to 55^{0}C. Dried samples were obtained after 24 hours.

After drying, the samples were allowed to cool down, packaged tightly in separate plastic bags, labeled and stored at room temperature (27^0-31^{0}C).

The complete experiment was carried out for a period of 49 days. Analytical procedures for proximate and microbiological changes were done after every 7 days.

2.2 Proximate and Microbial Analysis

The proximate composition (ash and moisture) of the fish samples were evaluated using the standard AOAC procedure (AOAC, 1995) [3]. The protein content was determined using the Lowry *et al.* (1951) [4]. The fat content was determined using Folch *et al.* (1957) [5]. The microbiological profile was determined according to APHA method (1984) [6].

2.3 Statistical Analysis

Mean and standard errors were calculated for different parameters. Data was expressed as mean ± SD and were analyzed by one-way ANOVA test using SPSS statistical programme.

3. Results and Discussions

3.1 Proximate Composition

The proximate composition of sun dried (SD) and oven dried (OD) samples of *Labeo rohita* stored at room temperature for a period of 49 days has been shown in the following tables:

Table 1: Proximate composition of sun dried muscle of *Labeo rohita* kept at room temperature (SD).

Days of Storage	0 day	7th day	14th day	21st day	28th day	35th day	42nd day	49th day
Total protein (%)	45.00^{a}±0.20	44.56^{b}±0.003	44.00^{c}±0.03	43.74^{d}±0.007	43.35^{e} ±0.19	42.87^{f}±0.04	42.14^{g}±0.53	41.86^{h}±0.40
Total lipid (%)	8.22^{a}±0.18	7.84 ^{b} ±0.01	7.45 ^{c} ±0.32	7.09 ^{d} ±0.15	6.84 ^{e} ±0.30	6.65 ^{f} ±0.22	6.25 ^{g} ±0.04	6.00 ^{h} ±0.10
Moisture (%)	9.18^{a}±0.05	9.72 ^{b} ±0.73	10.06 ^{c} ±0.13	10.27 ^{d} ±0.41	10.99 ^{e} ±0.004	11.20 ^{f} ±0.04	11.81 ^{g} ±0.33	12.11 ^{h} ±0.17
Ash (%)	15.93^{a}±0.12	15.72 ^{b} ±0.21	15.65 ^{c} ±0.06	15.45 ^{d} ±0.008	15.19 ^{e} ±0.42	14.89 ^{f} ±0.04	14.40 ^{g} ±0.04	14.19 ^{h} ±0.28

Table 2: Proximate composition of oven dried muscle of *Labeo rohita* kept at room temperature (OD).

Days of storage	0 day	7th day	14th day	21st day	28th day	35th day	42nd day	49th day
Total protein (%)	48.98^{a}±0.002	48.60^{b}±0.13	48.01^{c}±0.03	47.82^{d}±0.89	47.38^{e} ±0.04	46.89^{f}±0.0 1	46.50^{g}±0.11	46.00^{h}±0.43
Total lipid (%)	10.89^{a} ±0.19	10.65^{b}±0.020	10.12^{c}±0.81	9.92^{d} ±0.02	9.78^{e}±0.17	9.39^{f}±0.12	9.01^{g}±0.0 1	8.90^{h}±0.11
Moisture (%)	8.00^{a}±0.13	8.54^{b}±0.01	8.91^{c}±0.50	9.32 ^{d}±0.33	9.88 ^{e} ±0.59	10.26^{f}±0.0 1	10.93^{g}±0.25	11.18^{h}±0.77
Ash (%)	18.77^{a}±0.06	18.60^{b}±0.15	18.51^{c}±0.43	18.37 ^{d}±0.002	18.23 ^{e} ±0.80	17.95^{f}±0.0 7	17.63^{g}±0.16	17.05^{h}±0.0 1

Table 3: Percent change in proximate composition of sun dried muscle of *Labeo rohita* kept at room temperature (SD).

Days	Total protein (%)	Total lipid (%)	Ash (%)	Moisture (%)
0-7	0.97	4.62	1.31	5.88
0-14	2.22	9.36	1.75	9.58
0-21	2.79	13.74	3.01	11.87
0-28	3.66	16.78	4.64	19.71
0-35	4.73	19.09	6.52	22.80
0-42	6.35	23.96	9.60	28.64
0-49	6.97	27.00	10.92	31.91

Table 4: Percent change in proximate composition of oven dried muscle of *Labeo rohita* kept at room temperature (OD).

Days	Total protein (%)	Total lipid (%)	Ash (%)	Moisture (%)
0-7	0.77	2.20	0.90	6.75
0-14	1.98	7.07	1.38	11.37
0-21	2.36	8.90	2.13	16.5
0-28	3.26	10.19	2.87	23.5
0-35	4.26	13.77	4.36	28.25
0-42	5.06	17.26	6.07	36.62
0-49	6.08	18.27	9.16	39.75

3.1.1 Protein Content

Table 1 and 2 indicate a decline in the total protein content of both SD and OD samples with increase in the storage period. Similar to present findings Al Reza *et al.* (2015) [1] in *Laubuka dadiburjori* and Rahman *et al.* (2017) [19] in *Channa punctatus* reported a significant decrease in protein content of dried fish samples stored at room temperature. This decrease in the protein content could be attributed to the gradual degradation of the initial crude protein to more volatile products, such as Total Volatile Bases (TVB). Table 3 and 4 reveal that after 49 days, the total percental decrease was 6.97% in SD while 6.08% in OD sample. This shows that the percentile decrease is less in the oven dried sample as compared to the sun dried sample.

3.1.2 Lipid content

Perusals of Table 1 and 2 clearly reveal that the lipid content decreased significantly from first day to the last day (49th day) of storage in both SD and OD samples. A similar decline in the lipid content of salted dried fish samples was reported by Latifa *et al.* (2014) [13] in *Mystus tengra* and Farid *et al.* (2017) [8] in *Channa punctatus* and *M. tengra.* The nutritional components such as protein, lipid, and ash were increased due to the loss of water in fish muscles during salting and drying process (Chaijan 2011) [6]. The present findings were also in line with Gandotra *et al.* (2014) who found a lesser percentage decrease in T_LC of brined muscle (20.58%) compared to the raw muscle (24.19%) of *Tor tor* who suggested that this might

be due to the reason that salt slows down lipid hydrolysis. The total percental decrease in SD samples was found to be 27.00% while it was found to be 18.27% in OD samples, after 49 days of storage (table 3 and 4).

3.1.3 Moisture Content

Inquisitive study of Table 1 and 2 reveal that the total moisture content of sun dried as well as oven dried samples increased from day 0 to day 49. This is in accordance with the results of Owaga *et al.* (2010) [17] in *Rastrineobola argentea*, Kumar *et al.* (2013) [12] in *Labeo gonius* and Rahman *et al.* (2017) [19] in *Channa punctatus*. This phenomenon of increasing moisture content during storage is due to absorption of moisture from surrounding atmosphere Farid *et al.* (2017) [8]. The total percental increase in moisture content was observed to be 31.91% in SD while 39.75% in OD after 49 days of storage.

3.1.4 Ash content

Table 1 and 2 depict that a decreasing trend was found in the ash content of both sun dried and oven dried samples. A total percental decrease of 10.92% in SD and 9.16% in OD samples was observed after 49 days of room temperature storage (table 3 and 4). The nutritional components such as protein, lipid, and ash were increased due to the loss of water in fish muscles during salting and drying process (Chaijan 2011) [6] because as the moisture content reduces the concentration of other nutrient components increases (Pigott and Tucker, 1990) [18]. The effect of ground bones and scales in dried fillets could also have resulted into increase in ash content (Alsaban *et al.*, 2014) [2].

3.2 Microbial Analysis

To assess the microbial load of SD and OD samples Total Plate Count (TPC) and Coliform Count (CC) were analyzed for a period of 49 days.

Table 5: Bacteriological changes in sun dried muscle of *Labeo rohita* kept at room temperature (SD).

Days of storage	0 day	7th day	14th day	21st day	28th day	35th day	42nd day	49th day
TPC*	$1.91^{a}\pm0.01$	$2.44^{b}\pm0.12$	$2.90^{c}\pm0.8$	$3.28^{d}\pm0.76$	$3.86^{e}\pm0.09$	$4.65^{f}\pm0.03$	$5.71^{g}\pm0.16$	**$6.35^{h}\pm0.07$**
CC**	$0.47^{a}\pm0.03$	$0.89^{b}\pm0.5$	$1.04^{c}\pm0.01$	$1.18^{d}\pm0.12$	$1.65^{e}\pm0.06$	$1.80^{f}\pm0.02$	$2.01^{g}\pm0.07$	$2.21^{h}\pm0.11$

Table 6: Bacteriological changes in oven dried muscle of *Labeo rohita* kept at room temperature (OD)

Days of storage	0 day	7th day	14th day	21st day	28th day	35th day	42nd day	49th day
TPC*	$1.04^{a}\pm0.04$	$1.35^{b}\pm0.5$	$1.84^{c}\pm0.15$	$2.12^{d}\pm0.09$	$2.87^{e}\pm0.41$	$3.32^{f}\pm0.18$	$3.90^{g}\pm0.06$	$4.8^{h}\pm0.20$
CC**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*Total Plate Count (log10cfu/g) **Coliform Count(log10cfu/g)
Mean SD with different superscripts in a row differs significantly (P<0.05)

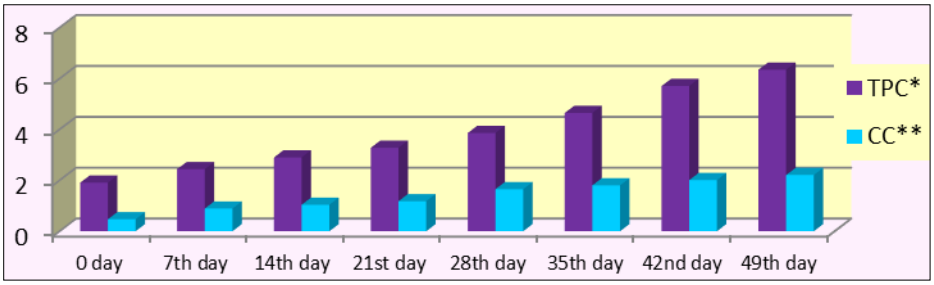

Fig 1: Bacteriological changes in sun dried muscle of *Labeo rohita* kept at room temperature (SD).

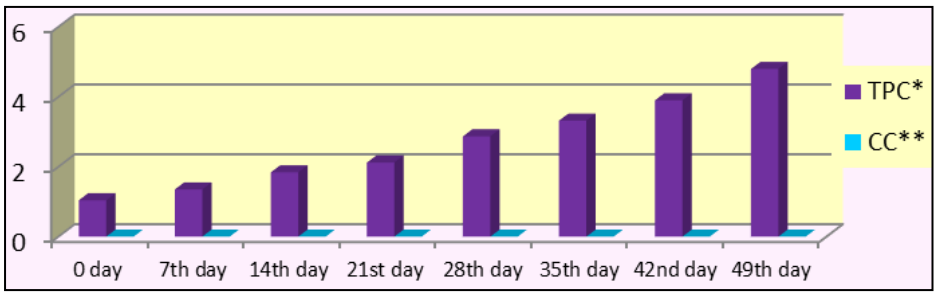

Fig 2: Bacteriological changes in oven dried muscle of *Labeo rohita* kept at room temperature (OD).

Results shown in Table 5 and 6 depict that the values of TPC and CC increased with increase in the storage period.

3.2.1 Total Plate Count (TPC)

The initial value of TPC was found to be 1.91±0.01 log cfu/g which increased to 6.35 ±0.07 log cfu/g in the sun dried sample where as it increased from 1.04±0.04 log cfu/g to 4.8±0.20 log cfu/g in oven dried sample, on the last day (49th day) of storage. Thus, the SD sample were within the permissible limit of TPC (6 log cfu/g) on 42nd day of storage while in oven dried muscle the value of TPC was maintained within the permissible limits till the end of storage period of

49 days thus making it recommendable for human consumption even after this time period of 7 weeks. In line with the present findings, Nahid *et al.* (2017) [8] in *X. cancila* (kaika) fish reported that TVC increased significantly in both room-temperature and refrigerator stored dried samples. As the duration of storage increased the processed fish might have absorbed small amounts of moisture from surrounding atmosphere providing enabling environment for microbial growth (Eyo, 2006). Present findings are also in accord with Kumar *et al.* (2013) [12] reported that on 0 day the value of TPC was lower in oven dried kursa (2.53×10^2) as compared to sun dried *Labeo gonius* (2.94×10^2).

3.2.2 Coliform Count (CC)

The value of CC showed an increasing trend with increase in storage period in sun dried sample of rohu but it was observed to be nil in oven dried sample throughout the storage period of 49 days. Similar to present results, Basu *et al.* (1989) [5] and Relekar *et al.* (2014) [20] reported that fish samples dried in laboratory by various methods were free from total coliforms throughout the study period due to the hygienic practices followed during processing and drying of fishes. Gabriel and Alano-Budiao (2015) [10] also found that coliforms were not isolated from the mechanically dried samples of salted herring (*Sardinella fimbriata)*.

4. Conclusion

Thus, these results clearly indicate that the use of oven drying as a method of fish preservation is more effective is the retardation of growth of microorganisms in the fish muscle along with the extension of its shelf life.

5. References

1. Al-Reza S, Karmaker S, Hasan M, Roy S, Hoque R, Rahman N. Effect of traditional fish processing methods on the proximate and microbiological characteristics of *Laubuka dadiburjori* during storage at room temperature. Journal of Fisheries and Aquatic Science. 2015; 10: 232-243.
2. Alsaban W A, Abou-El-Hawa S H, Hassan M A M, Abdel-Rahman M A. Effect of salting and storage on chemical composition of some fish species. Journal of Food and Dairy Science. 2014; (6):451-458.
3. AOAC. Official Methods of Analysis. 16th Edn., Association of Official Analytical Chemists, Washington, DC., USA, 1995.
4. APHA. Compendium of method of microbiological examination of foods. 2nd Edn, American Public Health Association, Washington DC, 1984.
5. Basu S, Kasim D I, Gupta S S, Rao C C P. Quality of dry fish from markets in Andhra Pradesh. Fishery Technology. 1989; 26(2):114-118.
6. Chaijan M. Physicochemical changes of tilapia (*Oreochromis niloticus*) muscle during salting. Food Chemistry. 2011; 129(3):1201-1210.
7. Eyo AA. Fish processing technology in the tropics. University of llorin Press, 2006.
8. Farid FB, Latifa GA, Chakraborty SC, Nahid MN, Begum M. Performance and quality assessment of sun-dried salted *Channa punctatus* (Bloch, 1793) and *Mystus tengra* (Hamilton-Buchanan, 1822) during refrigeration (4^0C) storage. International Journal of Food Science and Nutrition. 2017; 2(1):157-162.
9. Folch J, Less M, Sloane GWS. A simple method for the isolation and purification of total lipids from animal tissues. J. Biol. Chem. 1957; 226:497-509.
10. Gabriel AA, Alano-Budiao AS. Microbial, physicochemical, and sensory quality evaluations of salted Herring (*Sardinella fimbriata*) subjected to different drying processes. Food Science and Technology Research. 2015; 21(2):213-221.
11. Gandotra R, Gupta S, Koul M, Gupta V. Changes in biochemical and microbial charachteristics of raw and brined *Tor tor* during frozen storage. Journal of Environmental Science, Computer Science and Engineering & Technology. 2014; 3(3):1152-1163.
12. Kumar A, Prabjeet Singh A, Danish M. Changes in proximate, biochemical and microbiological characteristics of dried *Labeo gonius* fillets during storage at room temperature. African Journal of Biotechnology. 2013; 12(20):2997-3005.
13. Latifa GA, Chakraborty SC, Begum M, Nahid MN, Farid FB. Nutritional quality analysis of Bangladeshi fish species, *M. tengra* (Hamilton-Buchanan, 1822) preserved with different salt curing methods in laboratory condition. American Journal of Food and Nutrition. 2014; 2(6):100-107.
14. Lowry OH, Rosenbrough NJ, Farr AL, Randall RJ. Protein measurement with the folin phenol reagent. J Biol. Chem. 1951; 193:265-275.
15. Mohamed AA, Ahmed SH. Effect of drying on proximate and microbial analysis of dried *Clarias* sp. and *Tilapia* sp. collected from Gedaref Market, Gedaref state, Sudan. International Journal of Current Microbiology and Applied Sciences. 2016; (6):79-84.
16. Nahid MN, Latifa GA, Chakraborty SC, Farid FB, Begum M. Comparative quality assessment of *X cancila* (kaika) fish smoked with salt and garlic in different storage condition. European Journal of Biotechnology and Bioscience. 2017; 5(1):18-25.
17. Owaga EE, Onyango CA, Njoroge CK. Influence of selected washing treatments and drying temperatures on proximate composition of *dagaa* (*Rastrineobola argentea*), a small pelagic fish species. African Journal of Food, Agriculture, Nutrition and Development. 2010; 10(7):2834-2836.
18. Pigott GM, Tucker BW. Sea food effects of Technology on Nutrition. Marcel Dekker, Inc. New York, 1990.
19. Rahman MS, Rasul MG, Hossain MM, Uddin W, Majumdar BC, Sarkar MSI, et al. Impact of spice treatments on the quality and shelf life of sun dried Taki (*Channa punctatus*). Journal of Chemical, Biological and Physical Sciences. 2017; (2):409-420.
20. Relekar SS, Joshi SA, Gore SB, Kulkarni AK. Effect of improved drying methods on biochemical and microbiological quality of dried small head ribbon fish, *Lepturacanthus savala*. International Journal of Fisheries and Aquatic Studies. 2014; 1(5):60-66.