COMPARATIVE STUDY ON THE EFFECT OF DIFFERENT COOKING METHODS ON PHYSICOCHEMICAL PROPERTIES AND COLOR CHARACTERISTICS OF GOLDEN GREY MULLET (LIZA AURATA) FILLETS

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Abstract- The effect of different cooking methods (grilling, frying, steaming and microwave cooking) was investigated on proximate composition, cooking loss (CL), color and protein solubility (PS) of golden grey mullet (Liza aurata) fillet. Fillet's protein and ash contents significantly increased after cooking with all methods, compared to raw fillet. Higher protein content was related to microwave method, followed by fried, grilled and steamed, respectively. All treatments showed increase in protein and ash contents. Decrease in moisture and increase in fat contents was the most prominent changes in proximate composition. After cooking, PS of fillets decreased with decreasing pH with the minimum solubility was observed at a pH range 5-6 indicating the isoelectric point (PI) of fillets. Microwaved sample showed the lowest solubility compared to other cooking methods. All cooking processes reduced $L^*$ value and increased $b^*$ value. Fried and microwaved samples had significant differences in $a^*$ value compared to other treatments.

Keywords— Golden grey mullet, Cooking methods, Proximate composition, Protein solubility, Cooking loss, Color determination.

I. INTRODUCTION
About three millions juveniles of Black sea mullets (Mugil cephalus, L. aurata and Liza saliens) were successfully introduced to Caspian Sea over 1930 to 1934; however, only the two last species have successfully acclimated, adapted and propagated in the Caspian Sea (Oren, 1981; Kosarev and Yablonskata, 1994). Nowadays, they provided one of the important fishing resources, especially in the southern Caspian Sea. Among the large groups of fish species which have been consumed in Iran, golden grey mullet is one of the most important fish in southern Caspian Sea which have extensively been consuming with occupant of Gilan and Mazandaran regions (Abdoli and Naderi, 2009).

Fish is a major source of animal protein that has been consumed by humans (Hall, 1992). The high protein levels, with good digestibility and also low fat content are advantages of seafood (Pigott and Tucker, 1990). Interest in the health benefits of seafood such as existence of omega-3 fatty acids, decreased risk of prostate cancer (Terry et al., 2001) and Alzheimer diseases (Huang et al., 2005) is rising in the recent decades. Fish is usually treated by various processes before consumption. Heating (grilling, frying, steaming and microwave cooking) is applied to food to enhance its flavor and taste, inactivated pathogenic microorganisms and increase shelf life (Bognar, 1998). On the other hand, the use of the microwave oven for cooking has increased greatly during recent decades (Arias et al., 2003). The nutritive values of fish might be affected by processing or cooking methods. The effects of different cooking methods on nutritive values such as proximate composition of different fish have been previously studied (Weber et al., 2008; Ersoy and Ozeren, 2009). Fish are exposed to different conditions during cooking process which may, in turn, result in changes in their carotenoid content and may lead to color modifications (Bhattacharya et al., 1994). Solubility of protein is a paramount functional property of dehydrated products. The method of processing affects the solubility of protein especially if they are exposed to heat (Kilara and Harwalkar, 1996). Although the pH-solubility relationship for proteins has been studied in mugilidae (Mohan et al., 2007) and some reports are available on the composition of the fish, there is lack of information on the chemical composition, fillet color and nutritional profile of cooked L. aurata in southern Caspian Sea.

This study was, therefore, conducted to determine the influence of four cooking methods (grilling, frying, steaming and microwave cooking) on physicochemical properties of L. aurata fillets.

II. MATERIALS AND METHODS
A. Sample preparation
Three golden grey mullets (L. aurata) were purchased from Bandar-Torkman fish market, Golestan, Iran, during the autumn 2009. They were about 500g in weight. The fish were transported to the laboratory for sample preparation and analysis. On arrival at the laboratory the fish were washed with tap water several times to remove adhering blood and slime, they were then eviscerated, beheaded and their backbone, skin, tail and fins were removed yielding two fillets. Finally, fillet of each fish were divided in to 5 pieces to obtain total of 15 pieces. These 15 pieces were divided to 5 group (each contain 3 pieces) and each group was considered as one of the control, grilling, frying, steaming and microwave treatments. Each of the 3 pieces of the groups was analyzed separately as one replication of the group.

B. Cooking methods
Common ways of cooking were used. The samples were cooked by frying, grilling, steaming and microwave cooking. The fish fillets were fried in frying vegetable oil (Bahar frying oil, Iran). The temperature of oil during the frying process was 150°C over a 10 min period.