Available online at http://www.journalijdr.com

IJDR

International Journal of
DEVELOPMENT RESEARCH

ISSN: 2230-9926

International Journal of Development Research
Vol. 07, Issue, 06, pp.13310-13313, June, 2017

RESEARCH ARTICLE

EFFECT HANDLING TECHNIQUE OF SKIPJACK TUNA ON BOARD

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ARTICLE INFO

Article History:
Received 24th March, 2017
Received in revised form
29th April, 2017
Accepted 15th May, 2017
Published online 30th June, 2017

Key Words:
On Board Handling,
Pole and Line,
Skipjack Tuna,
Chilling Methods.

ABSTRACT

Bad handling technique on board for skipjack tuna could cause a decrease in the fish quality. Maintaining fish freshness plays an important role in determining quality of fish product. Study about chilling methods and storage time effect were conducted from November to December 2015. The study aimed to analyze the effects of different chilling method and storage time on the pH and organoleptics of skipjack tuna. Fish sampling were taken from the Seram Sea, Maluku Province. Chilling method was done by using different ratios of ice and fish: without ice, ratio of 1:1 between ice and fish, and ratio of 1:2 between ice and fish. The storage time for each treatment was 0, 2, 4, and 6 hours.The result of the study showed that chilling method using ratio of 1:1 between ice and fish and 6 hours storage time resulted in the best quality of fish with pH of 6.30 and organoleptics score of 8.79.

Citation: Christina Litaay, Sugeng HariWisudo, John Haluandan and Bambang Harianto. 2017. "Effect handling technique of skipjack tuna on board", *International Journal of Development Research*, 7, (06), 13310-13313.

INTRODUCTION

Akande and Diei-Ouadi Studies (2010) shows that in developing countries, post-harvest spoilage is about 20% to 40% of total production, and about 70% of that spoilage caused by the loss of fish quality. In the European Union (EU) approximately 350.000 cases of bacterial infection were caused by food as reported in 2011 (European Food Safety Authority (EFSA) Rohde *et al*. 2014). Although various attempts have been done to limit the level of food borne bacterial infections by implementing a higher standard of cleanliness and intensive testing, the number of infections remain high. Fish is food that is easily damaged by enzymes or microbiological spoilage, thus requires special handling. At present, the quality of fish is one of the biggest problem faced by food industries (Huss *et al*. 2003), since the consumers are demanding a proper appearance, smell, taste and texture (Warm *et al*. 2000).

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Generally in Indonesia, fishermen have not been handling fresh fish properly. A careless handling and limited cold chain system have led to degradation of thefish quality.Therefore, a freshness quality test of the fish is important. Availability of good fish quality would encourage people to have fish as part of their daily diet and this could lead to the improvement of the consumption of fish(protein intake) in Indonesia.To get the good fish quality, a proper fish handling has to be done. The proper fish handling prevents protein and omega-3 from damaged by the activity of microorganisms. When the fish is improperly handling, the protein in the fish will be used by microorganisms to multiply and degrades the quality of the fish. The degradation of fish quality may occur starting from catching process and continue until the final consumer (Quang, 2005). The implementation of the good handling technology or Good Handling Practices (GHP) since the fish in the boat until the land is required to avoid this issue. The damage of skipjack have brought about a consequence of a decrease in organoleptic quality. Thus, the solution is needed to tackle the degradation problem of the skipjack quality. The aim of the experiment was to analyze the effect of different chilling methods and storage time on the pH and organoleptics score of skipjack tuna.

MATERIALS AND METHODS

Materials

A total of 9 fishes were sampled. The fish used for observation without ice has total length average of 42.7±7.8 cm and an weight average of 3.1±1.3 g. The sampled fish use for treatment of ice and fish ratio of 1:1 has an average total length of 47.3±8.7 cm and average weight of 3.0±1.8 g, while for treatment of ice and fish ratio of 1: 2 has an average total length of 41.0±7.2 cm and average weight of 3.5±1.9 g.

Methods

Observations were conducted on the handling process of fish without using ice, ice and fish ratio of 1:1, and ice and fish ratio of 1:2. In this experiment there were 4 groups of time treatment, namely 0 hours, 2 hours, 4 hours, and 6 hours. In each experiment, then it was performed pH and organoleptic observations. pH value was analyzed by referring to AOAC (1995), while flesh fish organoleptic score was determined based on National Indonesian Standardization (SNI) No. 01-2346-2006 with grading scale ranging from 1 to 9.

Statistical Analyses

Data resulted from the experiments were processed using the SPSS statistical package version 16.1.0 for Windows. Analyses of the effect of chilling method (without using ice, ice and fish ratio of 1:1, and ice and fish ratio of 1:2) and storage time (0 hour, 2 hours, 4 hours, and 6 hours) on pH and organoleptics used factorial complete random design test, while the correlation of pH and organoleptic used linear regression test. The advanced test of Duncan performed when ANOVA on treatment had significant effect ($p<0.05$).

RESULTS AND DISCUSSION

Results

pH

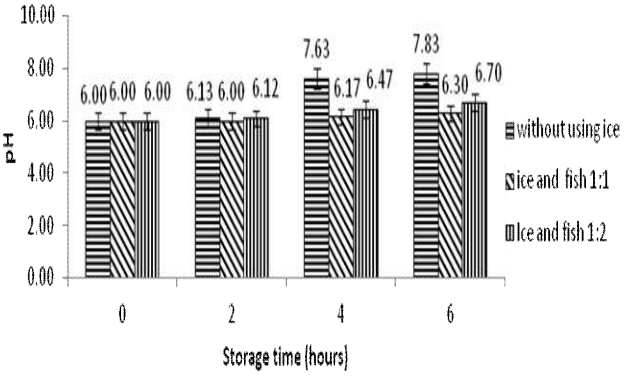

Figure 1. Histogram of the average pH value of the fish

Figure 1 shows the treatment of chilling methods and storage time affect the pH value of skipjack. Generally, chilling with ice is serve to maintain the fish stay fresh and to prevent spoilage so that the fish nutritional value can be maintained. The results of this study indicated that the pH of fish changed due to the influence of time and chilling. This illustrates that the quality of the fish was constantly changing with the increase in time since the death of the fish. The result of the analysis of variance shows that all the treatments, i.e. chilling methods, storage time, and the interaction between of these two factors, significantly affected the pH value of skipjack ($p<0.05$).The determination coefficient(R-Square)was 0.993.

Organoleptics score

Organoleptic test is one of parameters determining the freshness of fish. Through the organoleptic test the fish freshness can be simply known by observing the physical condition of the fish. Fresh fish has the same characteristics as live fish. The characteristics include good appearance, smell, taste, or texture. The result of experiment shows that the chilling methods treatment and storage time significantly affected the organoaleptics of the fish ($P<0.05$) (see Figure 2).

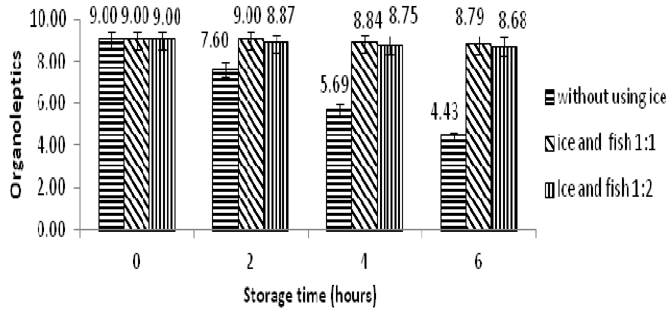

Figure 2. Histogram of the average organoleptics score of the fish

The result of analysis of variance shows that chilling method as well as the storage time and the interaction between these two factors significantly affected the organoleptics score of the skipjack ($p<0.05$). As shown in Figure 2, average values of the organoleptics of skipjack given the treatment of chilling methods with storage time of 0 hours provides the highest organoleptics score 9.00. The treatments of without ice, ratio of 1:1 of ice and fish and ratio of 1:2 of ice and fish combined with storage of time 6 hours resulted in the organoleptics scores of 4.43, 8.79 and 8.68 respectively

The correlation between pH and organoleptics of the fish

The pH level determines the organoleptic properties of the fish. Figure 3 shows the correlation between pH level and organoleptics score in the variation of the chilling methods. The linear regression analysis indicated that treatments without ice, ratio between ice and fish of 1:1 and 1:2 had very strong correlations between pH and organoleptics properties ($R>0.90$). The statistical test showed the significant effect ($p<0.05$) of fish handling with without ice, ratio ice and fish of 1:1, and ratio ice and fish of 1:2 on pH and organoleptics scores.

DISCUSSION

The results of this study indicate that the pH of fish changed due to the influence of time and chilling. This illustrates the quality of the fish constantly changed with the increasing of time since the death of the fish. According to Wheatom and

Lawson (1985), recast by the enzyme will produce alkaline compound that will cause the pH to increase.

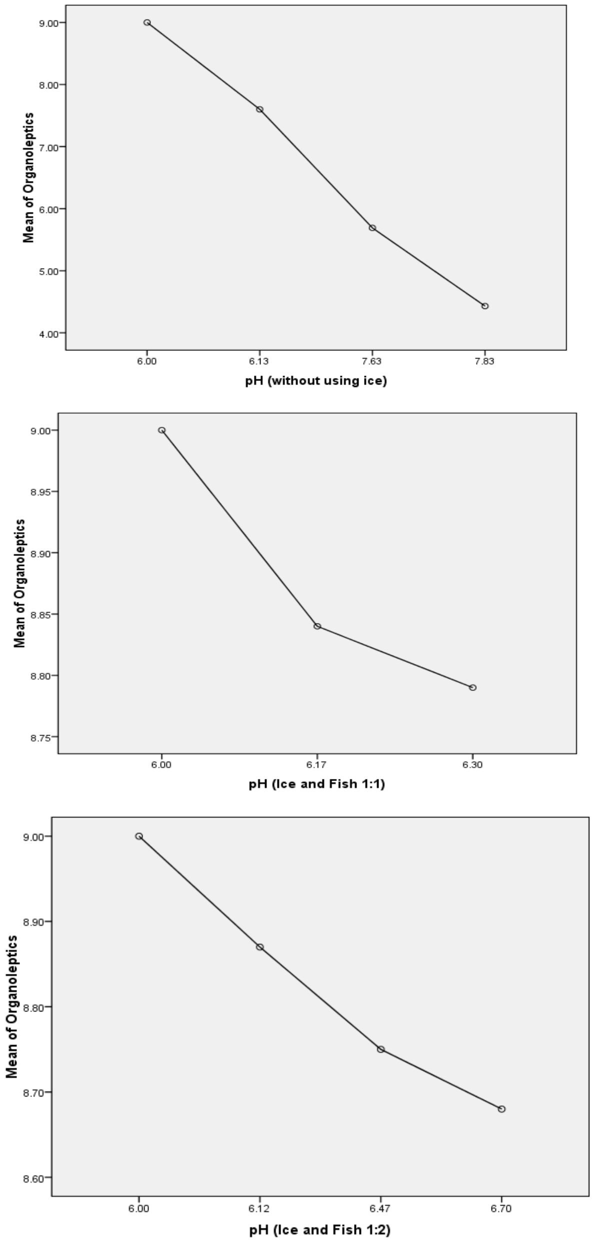

Figure 3. Correlation between pH and organoleptic of the fish

The result of the analysis of variance shows that either chilling method, storage time, and the interaction between these two factors, significantly affect the pH value of skipjack ($p<0.05$). The treatment of chilling method with ice and fish ratio of 1: 1 and 1: 2 resulted in lower pH values than the treatment without ice. This is because chilling process is the most common treatment in maintaining the quality of fisheries, particularly in the handling stages. When the chilling process has not been done in the handling stage then the degradation of quality will occur. In this case, chilling method with ratio of ice and fish 1:1 and 1:2 can maintain the quality of fish to remain fresh and decelerate the microbial work. According to Irian to and Susilo (2007), the ideal ratio of ice and fish for chill storage is 1:1.R^2equals to 0.993 indicates that the chilling method and storage time accounted for 99.3% of the variation of the pH value of the fish. The chilling product quality depends on the quality of raw materials, methods, and storage time (Sikorski, 1990). In this study, the fish quality was grouped into best quality if it has score of 3 (pH 6-7), good quality if it has score of 2 (pH<6), and bad quality if it only has score of 1 (pH>7). Organoleptic test by scoring test is done to know about the level of acceptance of the panelists which includes the reason or response to the resulting product ratings (Soekarto 1985).According to the Figure 2, it is seen that the longer of storage time with treatment of without ice brought about the lower organoleptic score. This may be caused by the energetic activities of bacteria and microbials and spoil the fish tissue in the treatment without ice, while in treatment with ice and fish with ratio of1:1 and 1: 2could inhibit the activity of bacterial decay. The decrease in quality was indicated by the decrease in the organoleptic score of the initial score of 9 shortly after the fish died on board. According to Andersen *et al*. (1995) and Sveinsdottir *et al*. (2002) organoleptic and texture scores decreased during storage process in the ice. Generally, the research result indicates that the organoleptics score of fish constantly decreased due to the longer storage time after the fish died. A complete randomized factorial of statistical analysis showes that treatment of chilling method and storage time has a significant effect ($p<0.05$) on organoleptic score. According to Nielsen *et al.* (2005) and Green-Petersen and Hyldig (2010), time and temperature are a very important factors for organoleptic quality because the loss of freshness is a major contributor to organoleptic quality. Green-Petterson *et al.* (2006) and Farmer *et al*. (2000) reported that not only species but also treatment and storage conditions greatly affect the characteristics of fish products. According Sakaguchi (1990) fish is said to be fresh when the sensory test value ranged from 9 to 7 and said unfresh when the value of a sensory test ranged from 4 to1.

Strong correlation indicates that pH level increases in accordance with the decrease in organoleptic score. Based on R-square value, fish pH has a contribution of 91.6% to influence organoleptic score in all chilling method treatments. Good quality fish usually has pH larger than 8. When the pH of the meat reaches ≥ 9 then the organoleptic score will reach about ≤ 3 in which the fish emits bad odor. According to Metusalach *et al.* (2012) the decomposition of proteins and other components that are containing nitrogen during the quality deterioration, the pH of the fish flesh will increase, and the higher of decay level, the higher of the pH of fish flesh. Rotten fish has a pH of about 10-11. On the other hand, the organoleptic score will continue to decline to the lowest score. Rotten fish (bad odor) has organoleptic score of less than 2. Despite the decrease of organoleptic score, the fish treated with ice and fish with ratio of 1: 1 and 1: 2 were still in good quality and worth consuming. Based on the criteria of organoleptic assessment, the fishes treated without ice were categorized as somewhat fresh, while fishes treated with ice and fish with ratio of 1: 1 and 1: 2 were categorized as fresh. The organoleptic score of fresh fish ranges from 7 to 9, the organoleptic score of somewhat fresh ranges between 4 to 6 and the organoleptic score of not fresh fish ranges from 1 to 3 (SNI 01-2346-2006). Thus, chilling methods using ice and fish with ratio of1:1 and 1:2 are categorized as good quality fish and are worth consuming.

Conclusion

The interaction of chilling method and storage time affect the pH level and organoleptic score of the fish. Chilling methods using ratio of 1:1 between the ice and fish with 6 hours storage time provided the best quality fish with pH of 6.30 and organoleptics score of 8.79.

Acknowledgments

The authors would like to thank the Ministry of Research and Technology for funding this research activity. Thank you also the authors to the LIPI Centre for Deep Sea Research, Ambon for its support and all parties who have participated in this research.

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