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Utilization of Rejected Salted Fish as Fish Meal

Hermon Hermon[1,*], Riska Riska[1], and Sahrul Sahrul[1]

[1] *Faculty of Animal Science. Andalas University. Padang. Indonesia*
[*] *Corresponding author. Email: herumonsan@yahoo.com*

ABSTRACT
This research aims to improve making a fish meal from the RSF to obtain high protein content without crude fiber (CF) and having nutritive value. The result is that fish meal has a low protein content and contains crude fiber. By using a completely randomized design with four replications, the RSF were treated with different boiling times. Namely T1 = 10, T2 = 20, and T3 = 30 minutes. The highest protein content (P< 0.05) was T2 (59.35%) and T1 (57.76%), and the lowest was T0 (30.11%). However, the lowest *in vitro* protein digestion (P< 0.01) was T2 (47.91%), and T1 (55.77%), and the highest was T0 (77.63%). Likewise, the NH3 content of T0 (15.09 mg / 100 ml) is relatively high compared to all boiled products. Otherwise, the highest BO content (P< 0.05) was T0 (82.49%) compared to all boiled products. After that, the OM digestibility and VFA content of T0 were relatively high compared to those of boiled products. It can be concluded that the boiling time of 10 - 20 minutes in the processing of RSF meal produces the best fish meal.

Keywords: *fish meal, digestion, NH3, VFA, in vitro.*

1. INTRODUCTION

Fish meal is a rich source of protein that contains high essential amino acids, and the protein is resistant to degradation in the rumen, which is greater than 60% [1, 2, 3]. The degradation-resistant protein, called undegradable protein (UDP), of fish meal as much as 67% could be digested 76% in the lower gut [4].

Based on an interview with a salted fish wholesaler in Padang City, West Sumatra, it was estimated that the production of salted fish in one month was approximately 15-20 tons, an average of 2-3 tons was the RSF [5]. The nutritional content of fish meals derived from the RSF was 22.8% crude protein, 3.4% crude fat, and 11.2% crude fiber [6]. The low protein content (22.8%) and the presence of crude fiber (11.2%) in the RSF meal might be caused by a mixture of fibrous materials (e.g., corn cobs) in order to grind the RSF easily. The moist RSF might cause difficulty in grinding the RSF without the mixture of fibrous material. The presence of crude fat could cause moist RSF. Therefore, the drying is blocked by the high enough crude fat of fish. The fat content of fish ranges from 1-20% [7].

Following the process of making the fish meal [8], to reduce the fat content of the RSF is boiling, pressing, and separating the liquid from the fat using a centrifuge. As a substitute for the centrifuge tool in this process, floating a cup filled with dry ice to bind the fish fat in the pressing liquid. Reducing the fat content will hasten to dry. Furthermore, it will also make it easier to grind into fish meals. It is hoped that low fat and rapid drying will cause a fish meal to be more durable in storage and not quickly rancid.

The description above has researched the length of time for boiling the RSF to get a quality fish meal.

2. MATERIAL AND METHOD

The experimental method of this research is a completely randomized design (CRD), with four treatments and four replications. RSF was boiled for 10 minutes (P1), 20 minutes (P2), and 30 minutes (P3). After boiling it, then put it into the cloth bag used the wheat flour bag. Then it will be pressed so that it is believed that all the liquid comes out and is accommodated in the pan. During drying, spray the liquid, its fat has been reduced floating a cup containing dry ice on the surface of the liquid in the pan so that some of the fat is attached to the wall of the cup and wiped by cloth. After drying, san was then ground and evaluated the chemical composition and in vitro digestibility of nutrients based on [9] method and compared to the RSF meal without boiling treatment (P0). P0 is the fish meal commonly marketed in Padang city, West Sumatera. The chemical composition of each treatment is shown in Table 1.

Table 1. Chemical composition of RSF meal with/without boiling treatment (%)

	P0[+)]	P1	P2	P3
DM	82.15	91.43	92.88	91.87
OM	82.49	70.97	70.51	70.27
Ash	17.51	29.03	29.49	29.73
Protein	30.11	57.76	59.35	53.00
Ether extract (EE)	1.31	6.10	5.27	4.79
Crude fiber (CF)	14.84	-	-	-
NaCl	13.46	14.30	14.21	13.01
NFE	36.23	7.11	5.89	12.48
TDN*	56.96	56.82	55.79	56.85

[+)] fish meal on the market *) Calculation results

2. Result and Discussion

The effect of treatment on the parameters is seen in Table 2.

Table 2. Chemical composition of RSFM (%)

	Treatment (Boiling duration/minute)				SE
	P0[+)]	P1 (10')	P2 (20')	P3 (30')	
DM	82.15[b]	91.43[a]	92.88[a]	91.70[a]	1.03
OM	82.49[a]	70.97[b]	70.51[b]	70.70[b]	0.53
Protein	30.11[c]	57.76[ab]	59.35[a]	53.00[b]	1.57

[a, b, c] different in the same row was significant (P< 0.05)
+) P0 was RSF meal without boiling treatment.

In Table 2, it is shown that RSF processed by boiling has a significant DM and protein content (P<0.05) higher but lower content of OM when compared to fish meal sold in the market (P0). It matters because, in the process of making fat of RSF was reduced, it was easier to dry and then increased DM levels, including protein content. At the same time, the low content of OM might occur because the fish meal was not added to other ingredients (corn cob or rice bran) as was commonly done by sellers of RSFM in Padang.

In Table 1 the CF content of P0 was 14.84%. However, the inclusion of this fiber fraction will then presently reduce the content of nutrients in commercial fishmeal, including protein content and salt content. In table 2 shown that boiling for 10-20 minutes shows high nutrient content, especially protein content (P<0.05). However, when seen in Table 1 that boiling 10-20 minutes (P1 and P2) has a relatively high NaCl content (14.21 - 14.30%) and relatively low energy content (55.79 – 56.82%) when compared to P0 and P3. Due to the extended treatment of boiling, it might dissolve nutrients and salt (NaCl) or decrease the quality of nutrients, especially proteins, due to heating. Furthermore, it will affect nutrient digestion, especially digestion/fermentation in the rumen, as shown in Table 3.

In Table 3 it appears that although the CF content of P0 was highest (14.84 %; Table 1) but the digestibility of DM and OM differ unsignificantly (P>0.05) compared to the digestion of the two nutrients in all three RSF meals, even fermentation of P0 protein was the highest (77.63%; P<0.05) compared to the three RSF meals. While P0 contains CF of P014.84% (Table 1), we know CF is a limiting factor in other nutrient digestion. It might be because P0 has a relatively low NaCl content and was not treated boiling (heating), affecting protein quality. The OM fermentation of P0 was not significantly different (P>0,05) than that of the three RSF meals. It could be suspected that cellulolytic rumen microbe was more tolerant to salt content. Similarly, in Table 3, it is shown that degradation of P0 protein was the highest (P<0.05; 77.63%), followed by P3, P1, and P2. It might occur because P0 had a low NaCl content (Table 1) and did not boiling (heating). The effect of heating (boiling) in the NaCl content of P0 (13.46%) was higher than P3 (13.01%), but protein degradation of P3 was lower (P<0.05; 60.79%) than that of the P0 (77.63%, Table 3).

In Table 3 above, it was shown that generally, the nutrient digestibility of P1 and P2 *in vitro two-stage* were higher (P<0.05) than those of P0 and P3. This indicates that salt content did not affect the activity of pepsin enzymes but might be due to the effect of high CF content of P0 and the length of boiling/heating in P3 (vis. 30 minutes).

Table 3. Nutrient digestion and *in vitro* rumen liquor profile of RSF meal

	Treatment (Boiling duration/minute)				SE
	P0[+)]	P1 (10')	P2 (20')	P3 (30')	
In Vitro Digestion (%)					
First Stage :					
DM	45.70	47.19	44.01	44.92	1.56
OM	39.11	40.28	38.49	38.42	1.57
Protein	77.63[a]	55.77[bc]	47.91[c]	60.79[b]	3.80
Two Stage :					
DM	78.46[a]	79.64[b]	79.97[b]	75.50[a]	1.03
OM	71.94[ab]	74.16[b]	73.72[b]	67.65[a]	1.11
Protein	82.65	85.35	81.52	80.94	2.28
Profil of Rumen liquor					
VFA; mM	122.5[b]	136.25[a]	113.75[bc]	106.25[c]	3.56
NH3; mg/100 ml	7.86[ab]	8.40[a]	7.33[bc]	7.015[c]	0.20
pH	7.12[a]	7.09[a]	6.93[b]	6.92[b]	0.04

[a, b, c] different in the same row was significant (P< 0.05)
[+)] P0 was RSF meal without boiling treatment

The VFA and NH3 concentration of P1 was higher (P<0.05) than those of P2, P3 and P0, as a result of high

fermentation of DM or OM. While the pH of P2 and P3 were significantly lower ($P<0.05$) than those of P1 or P0. This could occur because P1 protein undergone the fastest boiling/heating duration vis.10 minutes, while the P0 protein did not undergo boiling/heating treatment. The treatment of heating through the boiling of RSF would cause a decrease in solubility of nutrients, further decreasing the degradation/fermentation of these nutrients, especially proteins.

4. CONCLUSION

Based on the description above, boiling RSF (rejected salted fish) for 10-20 minutes product better quality of the fish meal in either nutrient content or in vitro nutrients digestion than boiling for 30 minutes.

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