HYDROLYSIS OF MYOFIBRILLAR AND SARCOPLASMIC PROTEINS IN PORK LOIN BY FREEZE-DRIED KIWIFRUIT POWDER AND ANTIOXIDANT PROPERTIES OF HYDROLYSATES

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I. INTRODUCTION

Kiwifruit contains actinidin, a cysteine protease. Compared to other plant-derived enzymes, actinidin does not excessively tenderise meat, and cause off-flavour or odour when apply to meat products [1]. Among the sensory attributes that determine consumer satisfaction, flavour and tenderness are important factors. Thus, tenderising tough meat cuts can be economically rewarding for the meat industry [2]. The objective of this study was to investigate the proteolytic activities of freeze-dried kiwifruit powders with various colours (red, gold, and green). And, then their applications to pork loin were evaluated as the degree of hydrolysis during the 90 mins of incubation time at 4°C. In addition, the antioxidant activity of bioactive peptide produced by pork protein applied with freeze-dried kiwifruit powder were also measured.

II. MATERIALS AND METHODS

Freeze-dried red, green, and gold kiwifruit powders were added to myofibrillar and sarcoplasmic proteins extracted from pork loin and incubated at 4 °C for 0, 30, 60, and 90 mins. Protease activity, Sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE), 2,2,-diphenyl-1-picrylhydrazylhydrate (DPPH) radical scavenging activity and reducing power were measured. Mean values were performed using Duncan's multiple range tests at a significant level of $P<0.05$.

III. RESULTS AND DISCUSSION

As shown in Figure 1, GOK and GRK exhibited higher activity than RK, regardless of protein sources, ($P<0.05$). In myofibrillar protein, the GRK showed higher activity than the GOK ($P<0.05$).

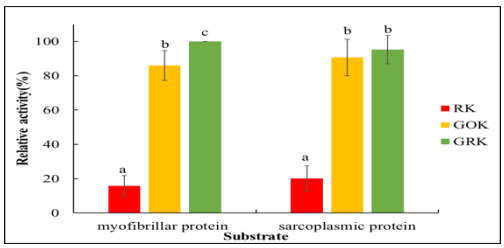

Figure 1. Protease activity of freeze-dried kiwifruit powder in pork proteins

RK, freeze-dried red kiwifruit powder; GOK, Freeze-dried gold kiwifruit powder; GRK, freeze-dried green kiwifruit powder; Different letters indicate statistically significant differences ($P<0.05$).

Figure 2 showed the SDS-PAGE profile by applying freeze-dried kiwifruit powder to myofibrillar and sarcoplasmic proteins from pork loin during incubation time. The hydrolysis rate was different, depending on the colour of the kiwifruit. The myosin heavy chain (MHC) band with PLR decreased from 90 min of incubation. And the MHC bands with PLGO and PLGR disappeared after 30 and 60 min, respectively. The sarcoplasmic protein band applied to GRK showed more protein changes than those with freeze-dried kiwifruit powder.

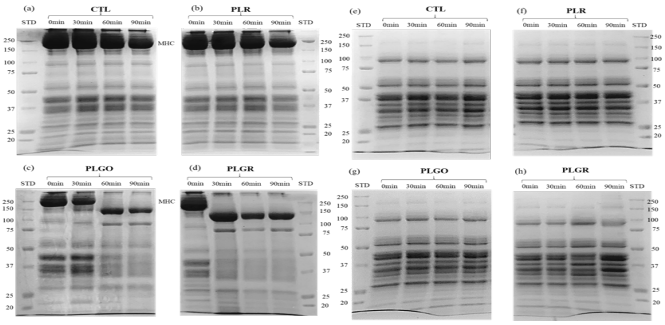

Figure 2. SDS-PAGE of the myofibrillar protein (a)-(d) and sarcoplasmic protein (e)-(h) applied with freeze-dried kiwifruit powder according to the incubation time (0, 30, 60, 90 min) (CTL, pork loin protein; PLR, pork loin protein with freeze-dried red kiwifruit powder; PLGO, pork loin protein with freeze-dried gold kiwifruit powder; PLGR, pork loin protein with freeze-dried green kiwifruit powder MHC, myosin heavy chain; Line STD, standard protein molecular weight marker)

The effects of myofibrillar and sarcoplasmic protein applied with kiwifruit during an incubation time on antioxidant activities are presented in Table 1. Higher antioxidant activity was shown in hydrolysates produced by freeze-dried gold (PLGO) and green (PLGR) kiwifruit powder as compared to those with freeze-dried red kiwifruit powder, depending on the various incubation times ($P<0.05$).

Table 1. Antioxidant activity of pork protein hydrolysates obtained using freeze-dried kiwifruit powder during incubation time.

		Time	Treatment				SEM	P-Value
		(min)	CTL	PLR	PLGO	PLGR		
DPPH radical scavenging activity (%)	Myofibrillar protein	30	2.23^{aA}	31.56^{aB}	32.28^{aB}	30.76^{aB}	3.91	< 0.01
		90	3.01^{aA}	32.25^{aB}	39.28^{bC}	45.77^{bD}	4.97	< 0.01
		SEM	0.31	1.02	1.53	3.49		
		P-value	0.28	0.71	0.02	< 0.01		
	Sarcoplasmic protein	30	1.52^{aA}	23.06^{aB}	25.66^{aC}	26.34^{aC}	3.35	< 0.01
		90	1.67^{aA}	32.69^{bB}	34.54^{bBC}	37.50^{bC}	4.34	< 0.01
		SEM	0.53	1.71	1.63	2.6		
		P-value	0.05	< 0.01	< 0.01	< 0.01		
Reducing power (O.D)	Myofibrillar protein	30	0.14^{aA}	0.65^{aB}	0.82^{aC}	0.90^{aC}	0.09	< 0.01
		90	0.16^{aA}	0.71^{aB}	0.86^{aBC}	0.93^{aC}	0.09	< 0.01
		SEM	0.02	0.02	0.02	0.05		
		P-value	0.94	0.5	0.87	0.77		
	Sarcoplasmic protein	30	0.26^{aA}	0.74^{aB}	0.83^{aC}	0.82^{aC}	0.08	< 0.01
		90	0.24^{aA}	0.89^{bB}	0.92^{bB}	1.03^{bB}	0.1	< 0.01
		SEM	0.02	0.05	0.02	0.05		
		P-value	0.77	0.01	< 0.01	0.03		

$^{A-C}$Means within the same row with different letters differ significantly ($P<0.05$); $^{a-b}$Means within the same column with different letters differ significantly ($P<0.05$).

IV. CONCLUSION

When applying kiwifruit as a tenderizer to meat products, the actual meat tenderness was controlled by selectively using the type of kiwifruit to have optimum activity. In addition, when freeze-dried gold and green kiwifruit powder were applied to pork meats, lipid oxidation could be delayed due to the production of bioactive peptides, resulting in maintaining meat quality during storage time.

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