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Comparison of Retail Marinated Shrimp Products Available in German Market According to Physical Parameters

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Abstract: Physical parameters of trade samples of marinated shrimp processed from Northern prawn (*Pandalus borealis*) and Giant tiger prawn (*Penaeus monodon*) both popular in Germany were characterised. Colour, texture (hardness, chewiness, adhesiveness, cohesiveness and elasticity), force of extrusion as well as Warner Bratzler (WB) shear force, water holding capacity measurements were done as physical measurements. From the characteristic view of physical properties of marinated shrimp products available in German supermarkets it became obvious that PMO and PMW were significantly different from PB, but also between PMO and PMW existed significant differences in texture. Water loss was lowest in PB. Colour differences ΔE* of 6.0, 10.0 and 14.5 have been calculated for PMW vs. PMO, PMO vs. PB and PMW vs. PB, respectively.

Key words: Marinated shrimp, physical properties, texture, colour, water holding capacity

INTRODUCTION

Marinades are solutions, including sugar, spices, oil, acids (from vinegar, fruit juice and wine) that are used to improve the tenderness, juiciness, flavour and aroma to extend the shelf-life of red meat, poultry, seafood and vegetables (Cadun *et al*., 2008).

Shrimps are popular after herring and sardine that have been used for producing marinated seafood in Europe. Different species of shrimp were used for marination technology in Europe. Furthermore, retail products of marinated shrimps popular in Germany were characterised for texture and colour to define objectives for later own development. These retail products are popular in German market so as in European market. There is less information in the study about physical parameters of these marinated shrimps.

The aim of this study is to determine the characteristic of physical properties of marinated shrimp products available in German supermarkets.

MATERIALS AND METHODS

The following marinated retail products were bought in a supermarket in Hamburg and were used for determination of colour and texture quality standards.

PB: Additives labelled-water, acetic acid, milk acid, citric acid, salt.

PM in oil (PMO): Additives labelled-Asian spices, plant oil, salt, garlic, parsley, E330, E210+E200.

PM in aqueous solution (PMW): Additives labelled-Asian spices, water, salt, E330, E210, E200, E954, E621.

Colour measurement: Colour measurement was performed using a tristimulus colorimeter CR 300 (Minolta, Ahrensburg, Germany) (Schubring, 2002). The colour was measured on homogenates prepared from shrimps by using a Krups3Mix 4000. The homogenate was placed in plastic petri dishes and the colour measurement was repeated ten times. In the CIE Lab system L*denotes lightness on a 0-100 scale from black to white; a^* (+) red or (-) green and b^* (+) yellow or (-) blue. ΔE*, the colour difference denotes the square root of ($\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2}$).

Texture measurement: Texture measurement was performed as instrumental Texture Profile Analysis (TPA) using a SMS Texture Analyser TA.XT 2/25 (Stable Micro Systems, Godalming, UK) according to Schubring (2002). The texture parameters hardness, chewiness, adhesiveness, cohesiveness and elasticity were measured by double compression of the sample with a test speed of 0.8 mm sec^{-1} using a cylindrical probe of 5.0 cm diameter. All TPA measurements were repeated 15 times using 15 different shrimps. Texture was further characterized by measuring the force of extrusion, using a modified Ottowa

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Test Measurement System (OTMS) comprising a square section test cell and loose fitting plunger area (7.0×7.0 cm) with the front plate removed (Schubring and Meyer, 2002). For investigation of the maximum shear force the TA.XT2 was equipped with a WB cell and the shrimps were sheared transversally to their body axis (Schubring and Oehlenschlager, 1997). Additionally to this texture, measurements on intact shrimps the penetration force of homogenized shrimps was also determined using the TA.XT2 fitted with a spiked aeration plunger equipped with 8 small cylinders, diameter 3 mm each, which are arranged in two different squares. Same test speed as mentioned above was used and measurements were repeated 3 times (Schubring, 2001).

Water holding capacity: WHC was characterized by measuring EM, which means the quantity of liquid squeezed from shrimps up a compression (Jonsson *et al*., 2001). EM was determined using a modification of the filter paper press method as described, elsewhere (Schubring *et al*., 2003). Samples were pressed between paired filter sheets (Schleicher and Schuell, 7×7 cm) and parallel plates using a texture analyser TA.XT2 (stable micro systems, Godalming, UK). A 25 kg load cell and a crosshead speed of 1.7 mm sec^{-1} were used. Samples were pressed to 60% deformation and held at the point for 15 sec. WHC was determined as the expressible moisture, calculated as:

$$\text{Percentage} = \frac{\text{Initial weight - final weight}}{\text{Initial weight}} \times 100$$

The results were statistically evaluated by using STATISTICA, SPSS (Mann Withney) (2 independent, kruskall walls (k independent)).

RESULTS AND DISCUSSION

Texture: Three retail samples offered in a German supermarket were compared regarding to their textural attributes with the aim to gain knowledge on physical attributes of established products. From the textural attributes measured (Table 1) it became obvious that PMO and PMW were significantly different from PB but also between PMO and PMW existed significant differences in texture. PB was significantly lower ($p<0.05$) in hardness, chewiness, WB shear force, extrusion force and elasticity compared with PMO and PMW. Differences in penetration force and cohesiveness, however, were not significant ($p>0.05$). On the other hand, PMO and PMW were quite different in hardness, PMO being harder, as well as in chewiness, PMO being chewier. Furthermore, WB shear force and force of extrusion were significantly higher for PMO ($p<0.05$). In contrast, values for cohesiveness and springiness were lower for PMO, while adhesiveness of PMO was higher. It was surprising that the product in oil was firmest compared with those in aqueous solution. Reasons for that behaviour could be manifold. Temperature during processing, pH, age of samples could be considered, for example.

Table 1: Texture attributes of retail products (Arithmetic means)

Texture attribute	PMW	PMO	PB
Hardness (N)	157.00±19.50^a	247.14±35.48^b	114.04±22.50^c
Chewiness	39.14±8.57^a	48.80±8.67^b	25.19±6.37^c
Cohesiveness	0.68± 0.04^a	0.66±0.02^b	0.71±0.02^a
Elasticity	0.78±0.05^a	0.72±0.04^b	0.63±0.03^c
Adhesiveness (Ns)	-0.12±0.03^a	-0.27±0.15^b	-0.18±0.06^c
Penetration (N)	4.09±0.19^a	4.14±0.18^a	4.67±0.44^a
Warner bratzler			
Shear force (N)	12.75±2.48^a	20.53±5.23^b	8.34±2.14^c
Force of extrusion (N)	105.53±26.00^a	244.38±41.37^b	66.56±26.83^c

Table 2: Expressible moisture of retail products (Arithmetic means)

No.	Water loss (%)
1	13.63±2.49^a
2	10.16±0.98^b
3	9.77±1.15^b

Table 3: Colour values of retail products (Arithmetic means)

Colour attribute	PMW	PMO	PB
L*	64.22±0.41^a	68.40±1.16^b	75.24±0.38^c
a*	15.47±0.52^a	11.25±0.49^b	9.91±0.44^c
b*	19.35±0.61^a	18.98±0.62^a	11.82±0.49^b

Different superscripts between columns characterize significant differences ($p<0.05$)

Water binding capacity: The expressible moisture of retail products seemed not to be species dependent. It could be seen that water loss (Table 2) was lowest in PB, while that of PMW was highest ($p<0.05$).

Colour: Colour measurements on retail products (Table 3) indicated significant differences ($p<0.05$) in L* and a* between all retail samples, while in b* the difference between PMB and PMO was not significant ($p>0.05$). L* was highest for PB followed by PMO and PMW. In a*, however highest values were taken from PMW followed by PMO and PB. PB was lowest in b* followed by PMO and PMW. Colour differences ΔE^* of 6.0, 10.0 and 14.5 have been calculated for PMW vs. PMO, PMO vs. PB and PMW vs. PB, respectively.

CONCLUSION

Retail products of marinated shrimps popular in Germany were characterised for texture and colour. Results can be used for later own development of marinated shrimp products.

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