Stretched Shrimp

CIFT's shrimp-stretching mould for Value Addition

B. Madhusudana Rao, L.N.Murthy, D. Jesmi and M.M.Prasad

Focal Points at a Glance: The authors tell us with a design and notes on a successful work done that the value of shrimp can be enhanced by stretching the body of shrimp using a CIFT designed mould.

Abstract

A food grade plastic mould made of low density polyethylene (LDPE), sized 30cm x 25cm x 5cm with grooves of six different widths i.e 11mm, 13mm, 15mm, 17mm, 19mm and 21mm and a uniform length of 21cm was designed and fabricated. The mould with these specific groove sizes was designed so as to accommodate the commonly available sizes of farmed shrimp. The stretched extension in length of shrimp (PUD) ranged between 1 and 3.2cm (7.4 and 50.8%) with a mean extension of 2.31±0.5cm (30.2±10%). The extension in length obtained by stretching using the plastic mould was above 2cm for the smaller grades of shrimp i.e., 31-40 and below. The stretching obtained for 31-40, 41-50, 51-60 and 61-70 grade vannamei was higher at 28.4%, 34%, 35% and 37%, respectively. The stretching was lower for under-20 and 21-30 grades at 9.95% and 17.7%, respectively. Stretched shrimp remain straight even after cooking. Battered and breaded stretched shrimp can be a potential value-added product for the domestic urban market.

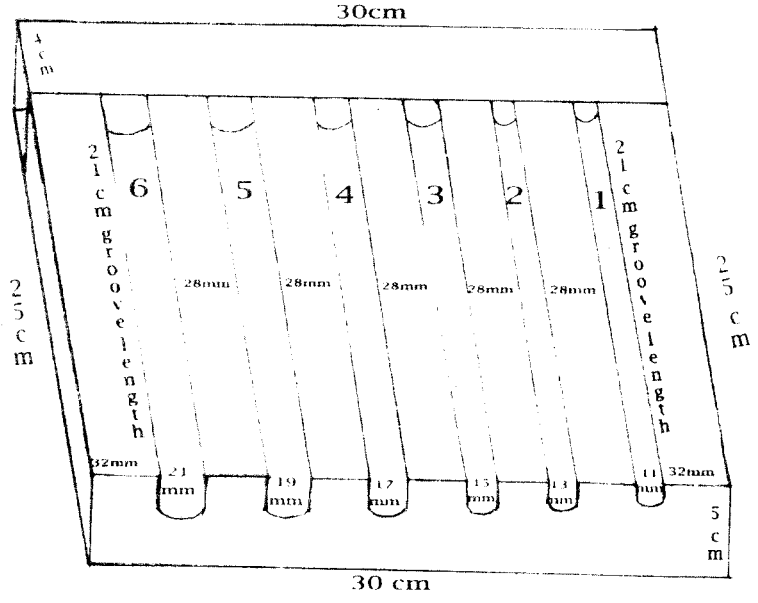

Fig 1. Dimensions of the CIFT-shrimp stretching mould with groves of six different widths for stretching shrimp.

Introduction

Value addition to shrimp by stretching has the potential to create consumer demand and increase profitability. Battered and breaded fish and shrimp products are gaining wider acceptance among the domestic consumers. Shrimp consumers are familiar with the fact that shrimp curl during cooking. Stretched shrimp do not curl even after cooking. Battered and breaded stretched shrimp can be a potential value-added product for the domestic urban market. Stretched shrimp is a product popular in Japanese cuisine, where it is known as *Nobashi*. The appearance of shrimp in stretched form can be a unique experience for many domestic consumers and opens new vistas for their marketing. However, a proper food grade mould is required for stretching different sizes of locally available shrimp.

Initially, a wooden mould (30 cm x 25cm x 5cm) with six grooves of different widths was designed and fabricated using *Adina cordifolia* wood [commonly known as Yellow teak wood (English); *Haldu* (Hindi); and *Bandaru* or *Pedda Kamba* in Telugu]. Although shrimp could be stretched using the wooden mould, the disadvantage with the wooden mould is that the mould gets stained with shrimp pigments on repeated usage. Moreover,

Research Centre of Central Institute of Fisheries Technology (CIFT), Pandurangapuram, Andhra University, P.O., Visakhapatnam-530 003. E - Mail: bmrcift@rediffmail.com

wood is not preferred in shrimp processing mainly to avoid microbial contamination. Keeping this in view, a food grade plastic made of low density polyethylene (LDPE) was employed for fabricating the mould.

The advantages of food graded plastic mould are:

- Ensures resistance to bending, chipping and cracking.
- Non-absorbent and non-porous surface will not absorb liquids and odours.
- Stain resistant
- Easy to clean
- Commercial dishwasher safe
- Food grade plastic complies with food preparation and sanitation standards

Design of the CIFT-shrimp stretching mould

Food grade plastic block of size 18" x 12" x 2" made of low density polyethylene (LDPE) available commercially was used as the base for making the mould. The mould sized 30cm x 25cm x 5cm was cut from the LDPE plastic block. Grooves of six different widths i.e 11mm, 13mm, 15mm, 17mm, 19mm and 21mm were chiseled out of the plastic block and the inner surface of the groove was smoothened. The groves were numbered 1 to 6, where groove 1 corresponded to 11mm groove and groove 6 corresponded to 21mm groove (Fig 1). All the grooves had a uniform length of 21cm. Handles for pressing the shrimp were prepared from the remaining piece of plastic block. Three handles of uniform length of 24cm but widths of 10mm, 14mm and 16mm were made. The handle of 10mm width would be suitable for grooves 1 and 2; 14mm handle would be suitable for grooves 3 and 4 and 16mm handle would be suitable for grooves 5 and 6. The surface of the handle is concave on the side pressing the shrimp, and convex on the opposite side. The base unit with the grooves and the handles form the components of the CIFT-shrimp stretching mould for stretching the Shrimp (Fig 2). The mould with these specific groove sizes was designed so as to accommodate the commonly available sizes of shrimp.

Process of stretching the shrimp

The process for stretching the shrimp is given as flow chart. Briefly, whole shrimp is converted to peeled undeveined shrimp (PUD). Fine, transverse cuts (2 to 3 cuts, depending on the size of shrimp) are made on ventral side of the PUD shrimp and are placed in the appropriate groove of the plastic mould (based on shrimp width) with the dorsal surface of the shrimp facing upwards. The shrimp fixed in the groove is pressed lightly using the plastic handle specific for that particular groove. This process converts PUD shrimp to stretched shrimp.

Flow chart for preparing battered and breaded stretched vannamei shrimp using CIFT-shrimp stretching mould

Whole vannamei shrimp[Head-on, (HON) shrimp]

↓

Separate the cephalothorax (head) using a stainless steel blade(Head-less, HL shrimp)

↓

Peel the shrimp manually(PUD, peeled undeveined shrimp)

↓

Make 2 or 3 transverse cuts on the ventral portion of the PUD shrimp using a sharp stainless steel blade.The cuts should be fine and about 1-2 mm depth

↓

Place the PUD shrimp with the dorsal side facing upwards in the appropriate groove of the CIFT-shrimp stretching mould. (The shrimp should tightly fit in the groove)

↓

Using the specific plastic handle lightly press the PUD shrimp, from the anterior position The concave side of the handle should be used for pressing the shrimp.Single press is sufficient. There is no need to apply extra force. (Fig. 3a)

↓

PUD shrimp gets stretched. (Fig 3b)(Stretched shrimp)

↓

Remove the stretched shrimp from the groove and cold blanch by soaking in chilled water containing salt (5%) and citric acid (0.1%) for 5 min.

↓

Batter and bread the stretched shrimp.

↓

Flash fry the battered and breaded stretched shrimp in hot vegetable oil at 180-200°C for 20 sec.

↓

Cool and use immediately or freeze and store at -20°C until further use.

↓

For use, deep fry the battered and breaded stretched shrimp for 10 minutes in refined vegetable oil at 180-200°C (Fig 3c)

↓

Battered and breaded stretched shrimp remain almost straight after frying, while the control shrimp (unstretched) curl during frying. (Fig 3c)

Battering and Breading process

Battered and breaded stretched vannamei was prepared by pre-dusting the stretched shrimp with dry batter and later coating the pre-dusted shrimp with an adhesive type quick setting batter (finely ground wheat flour *maida* 2000g, corn flour 200g, bengal gram 200g, salt 30g, guar gum 5g, turmeric powder 5g and sodium tri polyphosphate 10g) formulated at CIFT, Cochin (Joseph, 2009). All the ingredients were mixed evenly. This dry batter mix was used for pre-dusting the stretched vannamei. One part of dry batter was mixed with two parts of potable water to get the required consistency of the batter.

Characteristics of the Shrimp used for stretching

Farmed vannamei (*Litopenaeus vannamei*) shrimps (n=50) of different grades viz., under 20, 21-30, 31-40, 41-50, 51-60 and 61-70 grades were procured from a local shrimp processing plant. Grade indicates the numbers of whole shrimp per kilogram weight of shrimps. The head-on (HON), Headless (HL) and peeled undeveined (PUD) weights and head-on length of the different grades of vannamei shrimps are given in Table 1.

The yield obtained while converting HON vannamei to HL vannamei ranged between 62.4% and to 69.5% for different grades with an average yield of 65.2%. The yield from HL to PUD ranged between 78.7 to 84.8% for different grades of vannamei with an average yield of 82.4%.

Results of stretching experiments

Shrimp were stretched as outlined in the flow chart given in the previous page. The groove sizes were numbered as 1, 2, 3, 4, 5 and 6 corresponding to grooves widths of 11cm, 13cm, 15cm, 17cm, 19cm and 21cm, respectively. For under 20

grade vannamei, 50% of the shrimp fitted in groove number 5 and 50% in groove number 4; for 21-30 grade vannamei 62% of the shrimp fitted in groove number 4 and 38% in groove number 3; for 31-40 grade vannamei 50% fitted in groove number 4 and 50% in groove number 3; for 41-50 grade vannamei 10% fitted in groove number 4 and 90% in groove number 3; for 51-60 grade vannamei 70% fitted in groove number 3 and 30% in groove number 2 and for 61-70 grade vannamei 50% fitted in groove number 3 and 50% in groove number 2 (Fig 4).

The result of stretching using the CIFT-shrimp stretching mould for different sizes of vannamei is given in Table 2 and Fig 5. The mean stretching (extension) obtained for Under-20 and 21-30 grade vannamei was relatively lower at 9.95% (1.25cm) and 17.7% (1.94cm), respectively. However, the stretching obtained for 31-40, 41-50, 51-60 and 61-70 grade vannamei was higher at 28.4% (2.26cm), 34% (2.64cm), 35% (2.41cm) and 37% (2.46cm), respectively.

Considering all the 50 shrimps as a single unit, the average length of the shrimps prior to stretching was 8.13cm and the mean length increased to 10.44 cm by stretching the shrimps using the plastic mould. The extension obtained ranged between 1 and 3.2 cm with a mean extension of 2.31±0.5 cm. The extension in length obtained by stretching using the plastic mould was above 2 cm for all the grades of shrimps for the smaller grades of 31-40 and below. The results suggested that the designed food grade mould was useful for preparing stretched shrimp.

Texture profile analysis (TPA)

Texture has been attributed as one of the most important quality factors for acceptability of product (Di Monaco *et al.*, 2008) and is defined as an expression of structural, mechanical and surface attributes detected through human senses (Szczesniak, 2002). Texture measurement of control vannamei (n=5) and stretched vannamei (n=7) was performed at room temperature employing a food texture analyser (Lloyd Instruments, An AMETEK Company, UK) equipped with a sensor of 50N. From the force time curve, parameters such as Hardness 1 (N), Hardness 2 (N), Cohesiveness, Springiness (mm), Gumminess (N), Chewiness (Nmm), Adhesiveness (kgf.mm) and Stiffness (kgf/mm) were determined. Hardness corresponding to the maximum force required to compress the sample; cohesiveness indicating the extent to which the sample could be deformed prior to rupture; springiness showing the ability of sample to recover its original form after the deforming force is removed; gumminess signifies the force needed to disintegrate a semi-solid sample to a steady state of swallowing (hardness x cohesiveness); chewiness implies the work needed to chew a solid sample to a steady state of swallowing (springiness x gumminess); adhesiveness and stiffness. The TPA results showed a decrease in hardness, springiness, chewiness and stiffness of stretched shrimp compared to control shrimp (Fig 6). Hardness 1, Hardness 2, Cohesiveness, Springiness, Chewiness, Stiffness of the stretched vannamei shrimp of the numbered grades reduced by 75.2, 78.7, 11.1, 35.2, 87.5 and 64.4% respectively. However, adhesiveness of the stretched vannamei shrimp (0.012) was higher than control shrimp (0.007). The results of TPA of stretched shrimp suggest that stretched shrimp are relatively easy to masticate and hence palatable across a wide range of age groups.

Table 1. Weights of Farmed vannamei (*Litopenaeus vannamei*) shrimps used for stretching.

Grade (number per Kg)	n (number of pieces tested)	Shrimp Weight (g)			Shrimp Length (cm)
		Head-On (HON)	Head less (HL)	Peeled (PUD)	Whole (HON)
U 20	2	53.25±1.1*	33.3±0.4	27.45±1.1	19
		(52.5 to 54)**	(33 to 33.6)	(26.7 to 28.2)	
21-30	8	43.2±3.4 (37.3 to 46.7)	27.5±2.2 (23.3 to 29.6)	22.9±1.7 (19.9 to 24.9)	17.6±0.4 (17 to 18)
31-40	10	28.3±1.8 (26 to 31)	18.5±1.9 (14 to 21)	15.3±1.6 (12 to 17)	16.14±0.6 (15.1 to 17)
41-50	10	23.9±1.5 (22 to 25)	16.6±1.4 (14 to 19)	13.6±0.7 (12 to 14)	15.55±0.3 (15 to 15.8)
51-60	10	17.3±0.9 (17 to 20)	10.8±0.8 (10 to 12)	8.5±0.7 (8 to 10)	14.21±0.3 (13.9 to 14.6)
61-70	10	14.6±0.8 (13 to 16)	9.9±0.6 (9 to 11)	8.4±0.7 (7 to 9)	13.57±0.2 (13.2 to 13.9)

* mean ± SD, ** range

Table 2. Lengths of different grades of Vannamei shrimps before stretching and after stretching using the CIFT-shrimp stretching mould

Grade	Length of PUD vannamei shrimp, cm		Extension (Stretching)	
	Before stretching	After stretching	cm	%
Under 20	12.75±1.1* (12 to 13.5)**	14±0.7 (13.5 to 14)	1.25±0.4 (1 to 1.5)	9.95±3.6 (7.4 to 12.5)
21-30	10.94±0.4 (10 to 11.5)	12.9±0.6 (11.5 to 13.5)	1.94±0.3 (1.5 to 2.5)	17.7±2.8 (13 to 22.7)
31-40	8.01±0.4 (7.3 to 8.5)	10.27±0.5 (9.5 to 11)	2.26±0.5 (1.3 to 3)	28.4±7 (19 to 35.5)
41-50	7.78±0.3 (7 to 8)	10.42±0.5 (9.5 to 11)	2.64±0.5 (1.8 to 3.2)	34±6.4 (25 to 42.7)
51-60	6.88±0.3 (6.5 to 7.3)	9.29±0.5 (8.5 to 10.1)	2.41±0.6 (1.2 to 3.2)	35±9.4 (16.4 to 48.5)
61-70	6.67±0.2 (6.3 to 7)	9.13±0.4 (8.5 to 9.5)	2.46±0.4 (1.9 to 3.2)	37±6 (28.8 to 50.8)

* mean ± SD, ** range

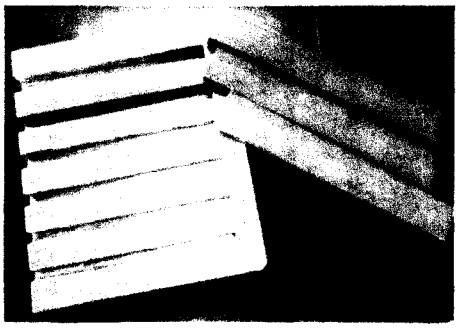

Fig 2. CIFT-shrimp stretching mould with groves of six different widths and the handles for stretching shrimp of different sizes.

Fig 3a. Stretching vannamei shrimp using groove number 3

Fig 3b(1). Stretched *L. vannamei* (PUD)

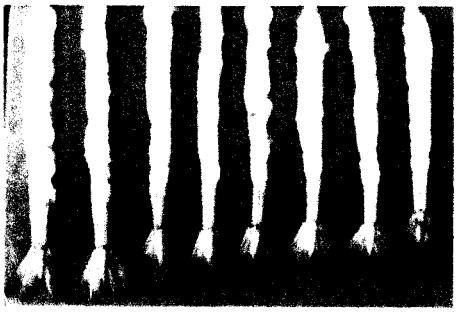

Fig 3b(2): Stretched *L. vannamei* (PUD Tail On)

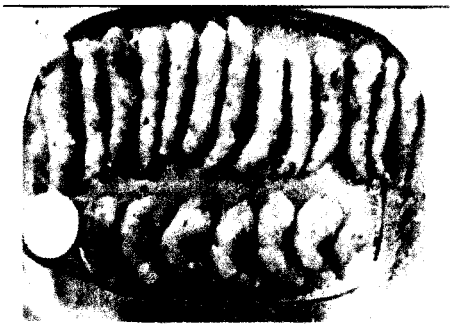

Fig 3c. Battered and Breaded Stretched *L.vannamei* (top row); Control *L.vannamei* (bottom row) after frying

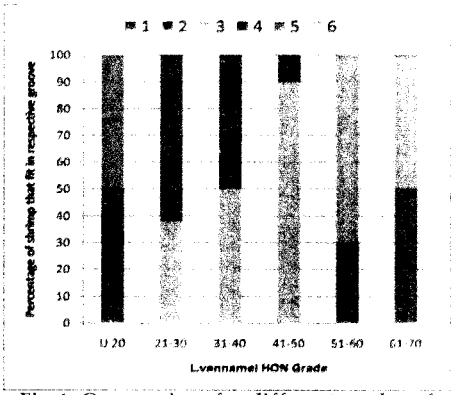

Fig 4. Groove sizes for different grades of Vannamei shrimp

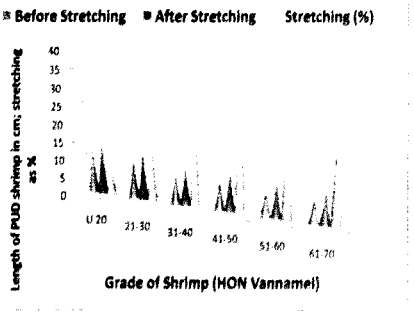

Fig 5. Increase in lengths of different grades of Vannamei shrimp by stretching using the CIFT-shrimp stretching mould

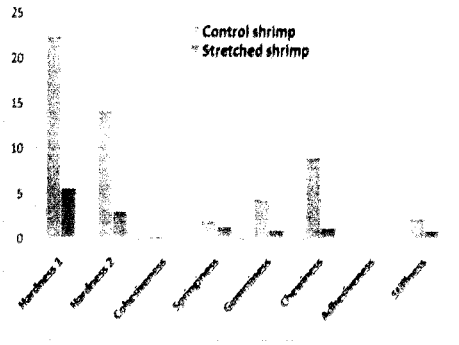

Fig 6. Comparison of the Texture profile of stretched and control vannamei

Acknowledgements: We express our thanks to Dr.T.K. Srinivasa Gopal, Director, CIFT, Cochin for the encouragement. Technical assistance rendered by A.K. Panigrahi and G. Bhushanam is gratefully acknowledged.

References

DI MONACO R., CAVELLA S., MASI P. (2008) Predicting sensory cohesiveness, hardness and springiness of solid foods from instrumental measurements. *Journal of Texture Studies* 39: 129-149.

JOSEPH, A.C. (2009). Coated products from freshwater fish and shellfish. In: *Post harvest technology of freshwater fish* (Joseph, J., Ravishankar, C.N., Zynudheen, A.A., Bindu, J., Ninan, G., Mohan, C.O. Eds.). Central Institute of Fisheries Technology, Cochin.

SZCZESNIAK, A.S. (2002). Texture is a sensory property. Food Quality and Preference 13(4): 215-225.

Integrated farming model for wetlands

Multi-commodity farming system consisting of rice, fish, broiled duck and male buffalo was evaluated at the Regional Agricultural Research Station, Kumarakom under the Kerala Agricultural University for productivity and income, cropping intensity and generation of employment.

The study revealed that a one hectare paddy holder in Kuttanad has the carrying capacity of a minimum of 5,000 fishes, 750 broiled ducks and 3-5 male buffaloes in addition to rice. In this system paddy is grown during June-October season.

Fish varieties: Fish fingerlings are stocked simultaneously in nursery ponds near the rice fields. A species composition of grass carp, rohu and catla at 2:1:1 at 10,000 fingerlings per ha is kept in view.

Ducklings are also stocked and they are fed with formulated feed. Spilled over feed and excrements of duck fertilise the fish ponds. It increases the primary productivity and growth of algae and higher plants.

Fishes feed on them and some of them consume duck droppings directly. The ducklings are sold after 45-50 days when they attain 2.1-2.5 kg body weight. In a year 5-8 batches of broiled ducks can be reared. Duck excrements to the tune of 9-10 tons are recycled for manuring the fish ponds.

Paddy harvest is done in 120-125 days and the fields get inundated after rice harvest. The nursery ponds are broken open and the fishes are released into the expanded water body.