Effect of Different Level of Natural Antioxidant Pomegranate Peel Extract Powder in Instant Functional Chicken Noodles

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Abstract

The noodles because of its variety, mouthfeel, versatility, convenience to use, it is widely accepted throughout the world and is relished by the people of all age group. But, the current study was conducted to incorporate Pomegranate peel extract powder (PG) at 3 different level viz., 0.5, 1 and 1.5 percent was added over and above the control chicken noodle formulation respectively. The dough pH, product pH, water activity and product yield did not show any significant difference between T1, T2 and T3 and were in the range of 7.382 – 7.390, 7.392 – 7.398, 0.501 – 0.510 and 95.329 – 95.662 respectively. The Water Absorption Index and Swelling Power Index decreased significantly (p<0.05) with the rise in concentration of PG, the treatment T3 had significantly (p<0.05) lower WAI and SPI than T2 and T3. The lightness and redness value significantly (p<0.001) decreased with the increase in concentration of PG in chicken noodles and yellowness did not show any significant difference between the test samples. The T3 had significantly (p<0.001) lower lightness values than all the test samples. The flavour, taste, softness and mouth coating scores were significantly (p<0.001) lower for T3. The panellists opined that the chicken noodles with PG incorporation at level above 0.5 per cent adversely affected the flavour, taste, softness and also overall acceptability.

Keywords
Pomegranate peel extract powder, Chicken, Noodles, Texture, Sensory and colour

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Introduction

The origin of the Noodle was first in Japan during 1950s. Noodles are generally prepared using various types of flours, water and salt usually cooked in soup or boiling water. Noodles are long thin piece of food made from unleavened dough from different types of ingredients. The instant noodles are the type of noodles precooked in oil or steam cooked and dried and marketed with packet of flavouring agent and consumed by all the age group of people both in urban and rural areas of the country. The synthetic antioxidants such as butylated hydroxyl anisole (BHA), butylated hydroxyl toluene (BHT), propyl gallate and
tertiary butyl hydroxyl quinone (TBHQ) are used in meat and meat products are known to exhibit various health effects.

The prolonged use of such synthetic chemicals can induce health hazards such as teratogenic and carcinogenic effects in laboratory animals and primates (Hathway, 1966). Because of these type of problems associated with synthetic antioxidants the current study was conducted to use natural antioxidant pomegranate peel extract powder in chicken noodles. Pomegranate fruit arils can be used to prepare flavoured juice, squash, jelly, wine, anardhana, etc and recently in chewing gum, jelly, ice cream and truffles. During the production of this type of products, Pomegranate peel waste disposal becomes a big problem and hence the powdered form is used in meat products which are likely to have more bioactive compounds than the pulp fractions (Balasundharan et al., 2006). Pomegranate can be used for medicinal purposes and are used in the treatment of inflammatory disease and disorders of the digestive tract (Lansky and Newman, 2007).

Keeping in view all the above facts, the present study was envisaged to attempt the use of PG as natural antioxidant in the development of functional meat products, a study was designed to evaluate the effect of different levels of PG powder at 3 different level viz, 0.5, 1 and 1.5 percent respectively on physicochemical properties, water hydration and sensory profile of noodles containing 70% chicken over and above the formulation.

Materials and Methods

Chicken

Spent chicken of 1.5 to 1.75 kg live body weight procured from the local market were scientifically slaughtered and dressed under hygienic conditions at Meat Technology Unit, Mannuthy. The dressed carcasses were stored under freezer conditions at (-23 ± 1°C) until thawed at 4±1°C before used for preparation of noodles. The dressed spent chicken is pressure cooked and deboned. The deboned chicken meat is minced in mincer (MADO primus Model MEW 613, Germany) for three times using 6mm plate and mixed with control formulation.

Vegetable oil

Refined sunflower oil (Sundrop) was used throughout the study for frying.

Spice mixture

A spice mix was prepared in the department specially for chicken noodles was used.

Natural Antioxidants

Pomegranate peel extract powder, PL99800, from Plant Lipids Private Limited, Cochin, Kerala.

The formulation of control noodles was standardized by conducting several trials. The standardized control formulation was used for the entire studies (Table 1).

Preparation of Control Noodles

The ingredients such as wheat flour, rice flour, maida flour, salt, sodium bicarbonate, potato starch, wheat gluten, guar gum and polyphosphates were used in the formulation of control noodles. Several trials were conducted to standardize the flour and chicken per cent in the control formulation. The sodium bicarbonate, potato starch, wheat gluten, guar gum and polyphosphates were mixed separately in hot water and then added to the flour mix. The flour mix prepared is put in to the “automatic pasta making machine” Dolly GB (Italy), and is kneaded for 10 min.
and water is added to it at 33% of control flour formulation and approximately 12% of chicken stock solution in chicken noodles to make dough of proper consistency and extruded.

The prepared raw noodles were then deep fat fried in sunflower oil at 180°C in electric single tank fryer. (Toastmaster model no. E-DZ-4L) for 45 seconds and then dried in hot air oven at 100°C for 30 min. The dried noodles were cooled at room temperature and then packed aerobically in laminated pouches (PE/AL/PA) and stored in dry place at ambient temperature.

Quality parameters analysed

pH

The dough pH and the product pH of the noodles from all the treatments and control, was determined using a combined electrode digital pH meter (μ pH system 362, Systronics, India) as per procedure of AOAC (2012).

Water activity ($a_w$)

For determination of $a_w$, the samples were cut into small pieces and filled in the sample cup up to the mark. The filled sample cup was kept in the measurement chamber of Lab swift $a_w$ meter (Novasina, Switzerland). The readings were taken, when the stable $a_w$ was on in the display (Cabonell et al., 2005).

Cooking yield percentage

The weights of fresh extruded noodles before and after frying stage of preparation were recorded. Product yield was expressed in percentage. The fried noodles are referred as raw noodles throughout this thesis (Berry et al., 1992).

Cooking yield (%) = \( \frac{\text{Weight of extruded fried noodles}}{\text{Weight of fresh extruded noodles}} \times 100 \)

Water hydration properties

The water absorption index (WAI), water solubility index (WSI) and swelling power index (SPI) of the rice flour samples were determined according to a reported method (Ohishi et al., 2007) with slight modifications. 1 g raw noodle was dispersed in 20 mL deionized water and agitated at 25°C and 100°C for 30 min, respectively. After centrifuging the dispersion at 15,000 g for 30 min, the supernatant was dried in a hot air oven at 105°C until a constant weight was obtained. WAI, WSI and SPI were calculated by the following formulae.

\[
\begin{align*}
\text{WAI} &= \frac{\text{Wet sediment weight}}{\text{Dry sample weight}} \\
\text{WSI} &= \left( \frac{\text{Dry supernatant weight}}{\text{Dry sample weight}} \right) \times 100 \\
\text{SPI} &= \left( \frac{\text{Wet sediment weight} \times 100}{\text{Dry sample weight} - \text{Dry supernatant weight}} \right)
\end{align*}
\]

Colour parameters

Colour of the steam raw noodles sample was determined objectively as per Page et al., (2001) using Hunter Lab Mini Scan XE Plus Spectrophotometer (Hunter Lab, Virginia, USA) with diffuse illumination. The instrument was set to measure Hunter $L^*$, $a^*$ and $b^*$ using illuminant 45/0 and 10° standard observer with an aperture size of 2.54 cm. It was calibrated using black and white calibration tiles before starting of the measurement and colorimeter score recorded with ‘L’ of black equals zero and ‘L’ of white equals 100, ‘a’ of lower numbers equals more green (less red), higher numbers equals more red (less green) and ‘b’ of lower numbers
equals more blue (less yellow), higher numbers equals yellow (less blue). The colour coordinates \( L^* \) (lightness), \( a^* \) (redness) and \( b^* \) (yellowness) of the samples were measured thrice and mean values were taken.

**Sensory evaluation**

The sensory evaluation was conducted by serving hot noodles cooked with the spice mix (4gm) that was developed in the department. 70gm of noodles was cooked in 420ml for 10 minutes at 120\(^0\) C in an induction cooker. The Sensory attributes of the noodles were assessed organoleptically using 8 point Hedonic scale score card with the help of seven semi-trained taste panelists drawn from the Department of Livestock Products Technology, Mannuthy, Thrissur, Kerala, India. The average of the individual scores was taken as the score for the particular attribute (Sirichokworrakit et al., 2015).

**Results and Discussion**

\( T_1 \), \( T_2 \) and \( T_3 \) samples were prepared by incorporating PG at level 0.5 per cent, 1 per cent and 1.5 per cent respectively. The best level of natural antioxidant (PG) was selected primarily based on the physico-chemical properties, water hydration, colour values and sensory attributes.

**Physico-chemical properties**

The physico-chemical properties of the functional chicken noodles with addition of different levels of pomegranate rind extract powder (PG) in \( T_1 \), \( T_2 \) and \( T_3 \) at 0.5 per cent, 1 per cent and 1.5 per cent respectively are presented in Table 2.

The dough pH and the product pH did not show any significant difference between \( T_1 \), \( T_2 \) and \( T_3 \) and were in the range of 7.382 – 7.390 and 7.392 – 7.398, respectively. In Naveena et al., (2008) work the pH of cooked chicken patties was found to be 6.38 – 6.10 at different level of incorporation of PG rind powder as antioxidants. Whereas, the water activity and frying yield did not show any significant difference between \( T_1 \), \( T_2 \) and \( T_3 \) and were in the range of 0.501 – 0.510 and 95.329 – 95.662 respectively. Naveena et al., (2008) found reduced water activity with rise in the pomegranate rind powder extract addition. Banerjee et al., (2012), found no variation in the product yield of the barcoli powder extract added goat meat nuggets.

**Water hydration properties**

The Water Hydration Properties of the functional chicken noodles with addition of different levels of pomegranate rind extract powder are presented in Table 3. The Water Absorption Index and Swelling Power Index decreased significantly (\( p<0.05 \)) with the rise in concentration of PG, the treatment \( T_3 \) had significantly (\( p<0.05 \)) lower WAI and SPI than \( T_2 \) and \( T_3 \). Water Solubility Index did not vary significantly among them. Similarly, Wang et al., (2004) reported that the extract of green tea as natural antioxidant at certain percentages could weaken the gluten matrix in bread texture quality affected water absorption property. But,

**Colour (L*\( a^* \)\( b^* \) values)**

The Colour parameters of the functional chicken noodles with addition of different levels of PG at 0.5per cent, 1per cent and 1.5per cent respectively are presented in Table 2.

The lightness and redness value significantly (\( p<0.001 \)) decreased with the increase in concentration of PG in chicken noodles and yellowness did not show any significant difference between the test samples. The \( T_3 \) had significantly (\( p<0.001 \)) lower lightness
values than all the test samples. Qin et al., (2013) found lower lightness ($L^*$), higher redness and reduction in yellowness in ground pork meat incorporated with pomegranate rind powder extract, pomegranate juice and Pomegranate Seed Powder Extract. In contrast to this result Banerjee et al., (2012) found no significant difference in redness, yellowness and hue values among chicken nuggets incorporated with different levels of broccoli powder extract.

**Sensory evaluation**

The sensory evaluation of chicken noodles incorporated with pomegranate peel extract powder is represented in Table 3.

The sensory evaluation of chicken noodles with pomegranate rind extract powder did not show any significant difference in appearance and colour, stickiness and mouth coating scores of chicken noodles. The PG incorporation disturbed the texture of $T_2$ and $T_3$ and also added black colour to the noodles even at 0.5 per cent and hence the scores of appearance and colour were less for $T_2$ and $T_3$. The flavour, taste, softness and mouth coating scores were significantly ($p<0.001$) lower for $T_3$. The panellists opined that the chicken noodles with PG incorporation at level above 0.5 per cent adversely affected the flavour, taste, softness and also overall acceptability. Naveena et al., (2008) reported no significant difference was observed for chicken flavor and overall acceptability in chicken nuggets on addition of PG peel extract powder as natural antioxidant in chicken meat patties.

The results of Pomegranate peel extract powder at 0.5 and 1 per cent and 1.5 per cent level in chicken noodles revealed that 0.5 percent of PG is the optimum level to be incorporated in the chicken noodle. Sensory evaluation also revealed that the PG incorporation disturbed the texture of $T_2$ and $T_3$ and also added black colour to the noodles even at 0.5 per cent. Addition of PG at higher level than 0.5 percent can effect the texture and reduce the water hydration properties.

Thus maximum level of pomegranate peel extract powder that can be incorporated in chicken noodles is 0.5 per cent and above this level adversely affecting the most of the sensory attributes.

**Table 1** Formulary for the preparation of control noodles

| Ingredients                  | Control Noodles (%) |
|------------------------------|---------------------|
| I.  1. Chicken               | 41.18%              |
| 2. Maida flour               | 29.48%              |
| 3. Wheat flour               | 14.7%               |
| 4. Rice flour                | 14.7%               |
| II.  1. Salt                 | 3%                  |
| 2. Sodium bicarbonate        | 0.5%                |
| 3. Potato Starch             | 5%                  |
| 4. Wheat gluten              | 0.4%                |
| 5. Guar gum                  | 0.2%                |
| Polyphosphate                | 0.2%                |

*Pomegranate rind extract powder and II were added over and above the standardised control formulation of I.*
Table 2: Physico-chemical, water hydration and colour parameters of the instant chicken noodles.

| Treatments                  | T<sub>1</sub>          | T<sub>2</sub>          | T<sub>3</sub>          | F- Value | p- Value |
|-----------------------------|------------------------|------------------------|------------------------|----------|----------|
| Dough pH                    | 7.390 ± 0.020          | 7.348 ± 0.037          | 7.382 ± 0.020          | 0.684<sup>ns</sup> | 0.520    |
| Product pH                  | 7.392 ± 0.062          | 7.390 ± 0.009          | 7.398 ± 0.015          | 0.014<sup>**</sup> | 0.986    |
| Water Activity              | 0.510 ± 0.001          | 0.509 ± 0.003          | 0.501 ± 0.002          | 0.059<sup>ns</sup> | 0.943    |
| Frying yield                | 95.329 ± 0.277         | 95.622 ± 0.084         | 95.561 ± 0.093         | 0.772<sup>ns</sup> | 0.479    |
| pH                          | 7.392 ± 0.062          | 7.390 ± 0.009          | 7.398 ± 0.015          | 0.014<sup>**</sup> | 0.986    |
| Water Activity              | 0.510 ± 0.001          | 0.509 ± 0.003          | 0.501 ± 0.002          | 0.059<sup>ns</sup> | 0.943    |
| Frying yield                | 95.329 ± 0.277         | 95.622 ± 0.084         | 95.561 ± 0.093         | 0.772<sup>ns</sup> | 0.479    |
| WAI                         | 3.652 ± 0.162<sup>a</sup> | 3.283 ± 0.063<sup>b</sup> | 3.265 ± 0.078<sup>b</sup> | 3.943<sup>*</sup> | <0.05    |
| Water Solubility Index (WSI)| 3.654 ± 0.162<sup>a</sup> | 3.111 ± 0.060<sup>b</sup> | 3.099 ± 0.075<sup>b</sup> | 0.776<sup>ns</sup> | 8.488    |
| Swelling Power Index (SPI)  | 30.525 ± 0.209<sup>a</sup> | 29.495 ± 0.360<sup>a</sup> | 28.425 ± 0.212<sup>b</sup> | 15.185<sup>**</sup> | <0.001   |
| a*                         | 9.707 ± 0.021<sup>a</sup> | 9.695 ± 0.070<sup>a</sup> | 9.137 ± 0.020<sup>b</sup> | 55.852<sup>**</sup> | <0.001   |
| b*                         | 16.22 ± 0.019<sup>a</sup> | 16.133 ± 0.057<sup>a</sup> | 16.032 ± 0.204<sup>b</sup> | 0.587<sup>ns</sup> | 0.568    |

T<sub>1</sub> – 0.3 per cent Aloe vera (AV)
T<sub>2</sub> – 0.6 per cent Aloe vera (AV)
T<sub>3</sub> – 0.9 per cent Aloe vera (AV)

Table 3: Effect of different level of Pomegranate on (*) Sensory attributes of instant chicken noodles.

| Treatments                  | T<sub>1</sub>          | T<sub>2</sub>          | T<sub>3</sub>          | Chi-square - Value | p- Value |
|-----------------------------|------------------------|------------------------|------------------------|---------------------|----------|
| Appearance and colour       | 7.208 ± 0.100          | 6.875 ± 0.085          | 6.375 ± 0.328          | 5.737<sup>ns</sup> | 0.057    |
| Flavour                     | 7.083 ± 0.154<sup>a</sup> | 6.625 ± 0.085<sup>b</sup> | 6.292 ± 0.187<sup>c</sup> | 7.758<sup></sup> | <0.05    |
| Taste                       | 7.167 ± 0.211<sup>a</sup> | 6.583 ± 0.139<sup>a</sup> | 6.250 ± 0.171<sup>c</sup> | 8.176<sup></sup> | <0.05    |
| Softness                    | 7.083 ± 0.154<sup>a</sup> | 7.000 ± 0.000<sup>a</sup> | 6.292 ± 0.277<sup>b</sup> | 7.000<sup></sup> | <0.05    |
| Stickiness                  | 6.958 ± 0.136          | 6.875 ± 0.085          | 6.542 ± 0.187          | 3.009<sup>ns</sup> | 0.222    |
| Mouth Coating               | 7.083 ± 0.105          | 6.708 ± 0.100          | 6.917 ± 0.053          | 5.745<sup>ns</sup> | 0.057    |
| Overall acceptability       | 7.208 ± 0.187<sup>a</sup> | 6.708 ± 0.077<sup>b</sup> | 6.500 ± 0.112<sup>c</sup> | 7.633<sup></sup> | <0.05    |

T<sub>1</sub> – 0.3 per cent Pomegranate (PG)
T<sub>2</sub> – 0.6 per cent Pomegranate (PG)
T<sub>3</sub> – 0.9 per cent Pomegranate (PG)

ns: non significant. The values are expressed as their Mean ± Standard error. (Number of observations =24)

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