Int.J.Curr.Microbiol.App.Sci (2019) *8*(10): 1858-1864

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 8 Number 10 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.810.216

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

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Keywords

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

Article Info

Accepted:
15 September 2019
Available Online:
10 October 2019

A B S T R A C T

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 T_1, T_2 and T_3 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 T_3 had significantly ($p<0.05$) lower WAI and SPI than T_2 and T_3. 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. 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.

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 quenone (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 extact 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 ofPG as natural antioxidantin 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 ± 1^0C) 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 at33% 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 180^0 C in electric single tank fryer. (Toastmaster model no. E-DZ-4L) for 45 seconds and then dried in hot air oven at 100^0 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 25^0C and 100^0C for 30min, respectively. After centrifuging the dispersion at 15,000 g for 30 min, the supernatant was dried in a hot air oven at 105^0C until a constant weight was obtained. WAI, WSI and SPI were calculated by the following formulae.

WAI =Wet sediment weight / dry sample weight

WSI = (Dry supernatant weight / dry sample weight)×100

SPI = (Wet sediment weight ×100/ Dry sample weight (100 - dry supernatant)

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^o 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_3at 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 powderare 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_1	T_2	T_3	F- Value	p- Value
Dough pH	7.390 ± 0.020	7.348 ± 0.037	7.382 ± 0.020	0.684^{ns}	0.520
Product pH	7.392 ± 0.062	7.390 ± 0.009	7.398 ± 0.015	0.0140^{ns}	0.986
Water Activity	0.510 ± 0.001	0.509 ± 0.003	0.501 ± 0.002	0.059^{ns}	0.943
Frying yeild	95.329 ± 0.277	95.622 ± 0.084	95.561 ± 0.093	0.772^{ns}	0.479
WAI	3.652 ± 0.162^{a}	3.283 ± 0.063^{b}	3.265 ± 0.078^{b}	3.943^{*}	<0.05
WSI	5.317 ± 0.202^{a}	5.237 ± 0.043^{b}	5.083 ± 0.108^{c}	0.776^{ns}	8.488
SPI	3.654 ± 0.162^{a}	3.111 ± 0.060^{b}	3.099 ± 0.075^{b}	0.478^{*s}	<0.05
L*	30.525 ± 0.209^{a}	29.495 ± 0.360^{a}	28.425 ± 0.212^{b}	15.185^{**}	<0.001
a*	9.707 ± 0.021^{a}	9.695 ± 0.070^{a}	9.137 ± 0.020^{b}	55.852^{**}	<0.001
b*	16.22 ± 0.019^{a}	16.133 ± 0.057^{a}	16.032 ± 0.204^{b}	0.587^{ns}	0.568

T_1 – 0.3 per cent Aloe vera (AV) L*- Lightness WAI- Water Absorption Index
T_2 – 0.6 per cent Aloe vera (AV) a*- Redness WSI- Water Solubility Index
T_3 – 0.9 per cent Aloe vera (AV) b*- Yellowness SPI- Swelling Power Index

ns- non significant, means with same superscript have no significant difference between them. The values are expressed as their Mean ± Standard error. (Number of observations =24)

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

Treatments	T_1	T_2	T_3	Chi-square - Value	p- Value
Appearance and colour	7.208 ± 0.100	6.875 ± 0.085	6.375 ± 0.328	5.737^{ns}	0.057
Flavour	7.083 ± 0.154^{a}	6.625 ± 0.085^{b}	6.292 ± 0.187^{c}	7.758^{*}	<0.05
Taste	7.167 ± 0.211^{a}	6.583 ± 0.139^{a}	6.250 ± 0.171^{c}	8.176^{*}	<0.05
Softness	7.083 ± 0.154^{a}	7.000 ± 0.000^{a}	6.292 ± 0.277^{b}	7.000^{*}	<0.05
Stickiness	6.958 ± 0.136	6.875 ± 0.085	6.542 ± 0.187	3.009^{ns}	0.222
Mouth Coating	7.083 ± 0.105	6.708 ± 0.100	6.917 ± 0.053	5.745^{ns}	0.057
Overall acceptabilty	7.208 ± 0.187^{a}	6.708 ± 0.077^{b}	6.500 ± 0.112^{c}	7.633^{*}	<0.05

T_1 – 0.3 per cent Pomegranate (PG)
T_2– 0.6 per cent Pomegranate (PG)
T_3 – 0.9 per cent Pomegranate (PG)

ns- Non significant. The values are expressed as their Mean ± Standard error. (Number of observations =24) # - based on eight point hedonic scales. 1- extremely low and 8- extremely high

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How to cite this article:

Pavan, M., T. Sathu, B. Sunil, C. T. Sathian, V. N. Vasudevan, A. Irshad and Kiran Kumar, S. 2019. Effect of Different Level of Natural Antioxidant Pomegranate Peel Extract Powder in Instant Functional Chicken Noodles. *Int.J.Curr.Microbiol.App.Sci.* 8(10): 1858-1864.
doi: https://doi.org/10.20546/ijcmas.2019.810.216