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Research paper

Effect of Machine Processing on the Quality of Animal Fat Reduced *Rista*

Qureshi AI[1], Ahmad SR[1*], Wani SA[1], Sofi AH[1], Rather MA[1], Nadeem S[1] , Shanaz S[1] , Hussain S Z[2], Nazir B[1] and Nazir T[1]

[1]*Division of Livestock Products Technology, F.V.Sc & A.H, SKUAST-Kashmir, Shuhama, 190006*

[2]*Division of Food Science & Technology, SKUAST-Kashmir, Shalimar*

ABSTRACT

The traditional method of processing of high fat *Rista* (a mutton based emulsion type meat ball) being labour intensive process with little control on hygiene, demands an alternative method to mechanize the process. An experiment was thus designed with five treatments, including one traditionally prepared *Rista* Tc (with 20% animal fat) and four machines made products, viz. M_0, M_1, M_2 and M_3 (animal fat reduced from 0 to 75%). The results revealed that the parameters (measured on per cent basis) like emulsion stability (mean equal to 91.23 and 90.06 in T_c and M_2, respectively), cooking yield (mean equal to 90.96 and 90.40 in T_c and M_2, respectively), moisture (mean equal to 63.54 and 61.88 in T_c and M_2, respectively), protein (mean equal to 15.77 and 15.98 in T_c and M_2, respectively), fat (mean equal to 16.84 and 17.95 in T_c and M_2, respectively) and ash content (mean equal to 2.36 and 2.02 in T_c and M_2, respectively) of *Rista* made with machine method were comparable to that of the *Rista* made with traditional method. The values for various sensory parameters showed an increasing trend with the highest value in M_2. The results of the instrumental colour values in terms of lightness (L*), redness (a*) and yellowness (b*) indicated that L*, a* and b* values were significantly ($p \leq 0.05$) affected by the replacement of animal fat with vegetable oil. Since the product remained acceptable up to M_2 treatment, it was concluded that 50% of animal fat can be replaced with vegetable fat without affecting the quality of *Rista*, prepared by machine processing instead of traditional one.

Keywords: *Kashmir, Wazwan, Meat products, Mechanize, Traditional, Colour*

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INTRODUCTION

Kashmir is well known for its traditional meat products, the cuisine collectively termed as '*Wazwan*' which comprises of flavorful ready-to-eat meat products which are usually freshly prepared and served hot as part of splendid meals. Since, *Wazwan* products have tremendous consumer acceptability; the standardization of the processing conditions can help to promote them at domestic as well as international markets (Rather et al. 2015). The *Wazwan* is comprised of 7 to 36 dishes that are mainly made up of mutton, chicken, fruits and vegetables. *Kabab, methimaaz, rogan josh, aab gosh, nate-yakhni, tabakmaaz, rista*, and *goshtaba* are important meat-based products, traditionally prepared from pre-rigor hot boned tender lamb meat (Samoon and Sharma, 1994). Among them, *Rista* is an emulsion based product prepared from meat with added fat, salt, cumin, and cardamom seeds. The marketability of all *Wazwan* dishes including *Rista* is mainly restricted to local populace because of the lack of scientific interventions necessary to upscale the product as there is a total ignorance among the traditional *Wazwan* handlers about the scientific and hygienic processing of the product. Traditional method of *Rista* preparation is a time consuming affair requiring a lot of manpower and its formulation is not standardized as well, thereby limiting its consumption locally. The objective of our study was to mechanize the process to make the technology commercially viable. This can be achieved by mechanizing its preparation so as to standardize the formulation to improve its functional potential and at the same time render the process time as well as labour efficient. Traditionally, *Rista* is prepared laden with high amount (20-30%) of animal fats, making it a potential cause of the greater incidence of lifestyle diseases such as obesity, hypertension, cardiovascular diseases and coronary heart diseases. Modern consumers have become highly conscious about their daily diet, necessitating the meat processors to develop healthy and nutritious meat products. Because fat has a very important role in texture and taste, removing it comp[1]letely from meat products will leave them unsuitable for consumption. An option for meeting both health and taste issues would be to replace less desirable animal fat with vegetable ones. Therefore, there is a dire need to find an alternative to traditional processing of *Rista*, wherein the control on the processing is efficient so as to render the whole procedure faster, yet hygienic and at the same time having control over the formulation of the product.

MATERIALS AND METHODS

Hind leg portions of the freshly dressed carcasses (preferably of the same age of 1 year) were procured from the local market. Deboning was immediately done and the lean meat obtained was used for the preparation of the product (immediately or later as per need). Animal fat used in the experiments was preferably obtained from the carcass of the same kill where from the lean meat was obtained. The product was processed both traditionally as well as using modern methods using machines like meat mincers and bowl choppers.

Traditional processing of Rista

In traditional processing of *Rista*, chunks of lean meat were subjected to manual pounding using a specially designed wooden hammer called '*goshpare*' ('*gosh*' means '*meat*' and '*pare*' means '*hammer*') over a stone platform called '*maz-kaane*' ('*maz*' means '*meat*' and '*kaene*' means '*stone*'). The lean meat was treated with salt and pounded to a great extent initially. Chilled lamb fat was pounded separately along with large cardamom seeds. Minced fat so obtained was incorporated into the lean meat at the desired

*Corresponding Author: sh.rafeh@gmail.com

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level and pounding was continued together with half the total quantity of ice flakes. The remaining ice was added and pounding continued for a sufficient period to achieve an emulsion of desirable consistency. The emulsion was moulded manually into spherical meat balls (50 g each), then chilled at 4±1 °C until cooking. Gravy was simultaneously processed to which meat balls were added and cooked for half an hour to get the finished product (Samoon, 1988).

Machine processing of Rista

Manual pounding as practiced in traditional method was replaced by using machines like meat mincer and bowl chopper for controlled and efficient production of *Rista*. Mutton chunks and chilled mutton fat were separately minced through 8 mm plate in a meat mincer (MSW-627). The required quantity of coarse ground mutton was placed in the Bowl Chopper (SCHARFEN, Germany) and chopped for 1 minute. To this, 2.5% salt was added and chopping continued for further 1 minute, after which 10% chilled water was added and chopping continued for 2 minutes. At this stage, mutton fat along with vegetable fat was added in different combinations and again chopping was done for 2 minutes. Large cardamom seeds were added towards the end and chopping was continued for 1 minute to obtain an emulsion of desirable quality (Samoon and Sharma, 1994). The raw emulsion obtained was then moulded into a shape of spherical balls. Meat balls were then cooked for about half an hour in boiling gravy along with spices and condiments. By adopting machine processing, we could ensure uniformity in the processing of the emulsion. The basic formulation of control *Rista* is given in Table 1.

Table 1: Basic formulation for *Rista*

Name of the ingredients	Traditional Method (%)	Machine Method (%)			
	T_C	M_0	M_1	M_2	M_3
Lean meat	80.00	80.00	80.00	80.00	80.00
Animal fat	20.00	20.00	15.00	10.00	5.00
Vegetable fat	0.00	0.00	5.00	10.00	15.00
			100.00		
To the above, following ingredients will be added (on weight basis)					
Common salt	2.50	2.50	2.50	2.50	2.50
Chilled water/Ice flakes	10.00	10.00	10.00	10.00	10.00
Large cardamom seeds	0.20	0.20	0.20	0.20	0.20

Preparation of gravy and cooking of Rista

In a thick-bottomed stainless steel vessel, water in the required quantity was heated and covered with a lid. Turmeric powder was added to it and boiling was continued for 15 minutes. Then red chilli extract, hydrogenated vegetable oil, garlic paste, large cardamom, small cardamom, cinnamon, cloves, dried ginger powder and fried leek paste were added to it. Boiling was continued for 20 minutes until the gravy of desired viscous consistency was obtained. Salt was added towards the end of cooking. The meat balls were removed from the refrigerator, transferred to the boiling gravy and cooked for 25 minutes. Now, obtained *Rista* with gravy was cooled to room temperature and then kept under chilled conditions in refrigerator until analysis. The recipe for *Rista* gravy is summarized in Table 2.

Table 2: Recipe for *Rista* gravy

Ingredients	Quantity (g) Rista
Meat balls	1000.00
Water	2000.00
Vegetable oil	125.00
Turmeric (Haldi) powder	25.00
Red chilli (Capsicum annum) extract	250.00
Large cardamom (Bada Ilaichi)	2.50.00
Small cardamom (Chotta Iliachi)	1.00
Cinnamon (Dalchini)	3.50
Cloves (Laung)	0.50
Dried ginger (Sonth) powder	4.00
Garlic (Lehsan) paste	8.00
Fried Leek (Pran) paste	50.00
Common salt	10.00

Analytical procedures

The emulsion stability of the raw samples was determined as per the method of Baliga and Madaiah (1970) with slight modifications. For cooking yield, the weight of *Rista* was recorded before and after cooking and then the values were expressed in percentage. The pH was determined by the method of Trout et al. (1992) by using digital pH meter (Model EE-011, Tanco Laboratory Equipments Ltd. India). The per cent moisture, protein, fat and ash content of the product samples were evaluated as per standard procedure of Association of Official Analytical Chemists (AOAC, 2019). For sensory evaluation, samples of products from all treatments were presented to the semi-trained experienced taste panel members consisting of scientists and post-graduate students of Faculty of Veterinary Sciences and Animal Husbandry, Shuhama, SKUAST-K for evaluation of various sensory parameters viz., appearance, flavour, juiciness, texture, mouth coating, binding, saltiness and overall acceptability as per 8-point descriptive scale (Keeton, 1983), where 8 is extremely desirable and 1 is extremely undesirable. The samples were suitably warmed before serving to the panelists. The colour analysis of all the samples was done by using a Hunter colour lab (Model Colour Flex; Hunter Associates Laboratory, VA, USA) with an 8 mm aperture set for illumination D45/10 standard observer angle.

Statistical Analysis

The data generated was analyzed statistically following the method of Snedecor and Cochran (1994) using SPSS version 20 software package. Analysis of variance by one way and two way was computed with 5% level of significance.

RESULTS AND DISCUSSION

The traditional method of emulsion preparation consumed more than 2 hours for emulsion preparation from five kg of mutton, while as the same process was completed within 20 minutes by using machines like meat mincer and bowl chopper. Moreover, the hygienic conditions were maintained in machine processing unlike in traditional processing. The product prepared by machine method was compared with that of traditional method.

The values obtained for effect of animal fat replacement on the physic-chemical and compositional quality of *Rista* are reported in Table 3. The replacement of 50 per cent of animal fat with vegetable fat (up to M_2 treatment) maintained the emulsion stability as well as cooking yield of *Rista* when compared with traditionally processed product containing animal fats only in the formulation. The results were in accordance with Asuming-Bediako et al. (2014) and Whiting (1987) who suggested that the difference in emulsion stability between fat and vegetable oil is small during processing of sausages in which pork back fat was replaced with emulsified vegetable oil. Similar trend have been observed by Koo et al. (2009) who reported that cooking loss values of patties processed with vegetable oil were significantly lower than those of patties processed with pork fat. Similarly, no significant changes happened in proximate parameters like protein, fat, moisture and ash content up to M_2 treatment. However, there was a drastic effect of vegetable fat on the quality of M_3 *Rista*, wherein 75 per cent of animal fat was replaced. Nutritional retention with replacement of animal fat for vegetable oil were also observed by Delgado-pando et al. (2011) and Rodriguez-carpena et al. (2012) who used healthier oil combination and konjac gel as functional ingredients in low-fat pork liver pate. The use of vegetable oil in meat products not only help in increasing unsaturated fatty acids but also reduce cholesterol content. Similar findings reported by Vural and Javidipour (2002), Kayaardi and Gok (2003) and Gok et al. (2011).

Table 3: Effect of method of preparation on the physico-chemical and compositional quality of Rista (Mean ± S.E.)

Parameters (%)	Treatments					
	T_C	M_0	M_1	M_2	M_3	Total
ES	91.23 ± 0.64^{b}	89.88 ± 0.96^{b}	90.36 ± 0.45^{b}	90.06 ± 0.34^{b}	87.35 ± 0.43^{a}	89.78 ± 0.42
Cooking Yield	90.96 ± 0.32^{c}	89.18 ± 0.62^{b}	89.31 ± 0.55^{b}	90.40 ± 0.25^{bc}	86.84 ± 0.42^{a}	89.34 ± 0.42
Moisture	63.54 ± 0.37^{ab}	63.21 ± 0.61^{ab}	62.95 ± 0.77^{ab}	61.88 ± 0.83^{a}	64.70 ± 0.85^{b}	63.25 ± 0.34
Protein	15.77 ± 0.21	15.80 ± 0.18	15.76 ± 0.18	15.98 ± 0.17	16.18 ± 0.25	15.90 ± 0.09
Fat	16.84 ± 0.29^{ab}	16.65 ± 0.28^{a}	17.72 ± 0.41^{bc}	17.95 ± 0.21^{c}	15.99 ± 0.40^{a}	17.03 ± 0.19
Ash	2.36 ± 0.16^{ab}	2.02 ± 0.02^{a}	2.04 ± 0.04^{a}	2.02 ± 0.11^{a}	2.47 ± 0.18^{b}	2.18 ± 0.06

Mean ± S.E with different superscripts differ significantly.

The values obtained for effect of animal fat replacement on the sensory quality of *Rista* are reported in table 4. The values for various sensory parameters showed an increasing trend with the use of vegetable fat up to M_2 treatment. The sensory quality was appreciated in control, M_1 and M_2 treatments by the sensory panellists. Similar findings were observed by Kayaardi and Gok (2003) and Yildiz-Turp and Serdaroglu (2008) who found that replacing beef fat with vegetable oils improved the quality characteristic of sausages. Ahmad et al. (2014) and Jalal et al. (2014) also found that the overall palatability scores were significantly better in restructured buffalo meat fillets extended with hydrated barley and low fat *goshtaba* formulated with sodium alginate, respectively. The sensory quality degraded for M_3 treatment, probably due to lowered emulsion stability and more cooking losses. Rovida *et al.* (2020) found desirable sensory quality in spent hen meat treated with ginger extract.

Table 4: Effect of method of preparation on the sensory quality of Rista (Mean ± S.E.)

Parameters	Treatments				
	T_C	M_0	M_1	M_2	M_3
Appearance	7.48 ± 0.13^{c}	6.86 ± 0.21^{b}	7.19 ± 0.14^{bc}	7.52 ± 0.13^{c}	5.67 ± 0.17^{a}
Flavour	7.00 ± 0.17^{b}	6.95 ± 0.22^{b}	7.09 ± 0.19^{b}	7.43 ± 0.11^{b}	5.76 ± 0.15^{a}
Juiciness	6.81 ± 0.15^{b}	6.90 ± 0.22^{b}	7.14 ± 0.14^{bc}	7.48 ± 0.13^{c}	5.62 ± 0.23^{a}
Texture	7.29 ±0.16^{bc}	6.90 ± 0.27^{b}	7.38 ± 0.13^{bc}	7.48 ± 0.11^{c}	5.14 ± 0.16^{a}
Mouth Coating	7.05 ± 0.18^{b}	7.00 ± 0.21^{b}	7.04 ± 0.22^{b}	7.52 ± 0.15^{b}	6.19 ± 0.26^{a}
Binding	6.95 ± 0.20^{b}	6.86 ± 0.30^{b}	7.33 ± 0.16^{bc}	7.71 ± 0.10^{c}	5.43 ± 0.25^{a}
Saltiness	6.52 ±0.25^{ab}	7.05 ±0.16^{bc}	6.86 ± 0.16^{abc}	7.19 ± 0.11^{c}	6.33 ± 0.25^{a}
Overall Acceptability	6.81 ± 0.18^{b}	6.86 ± 0.20^{b}	7.29 ± 0.14^{bc}	7.57 ± 0.11^{c}	5.71 ± 0.21^{a}

Mean ± S.E with different superscripts differ significantly

The values of colour attributes like lightness (L*), redness (a*) and yellowness (b*) measured in *Rista* are shown in Table 5. The results indicated that L*, a* and b* values were significantly ($p \leq 0.05$) affected by the replacement of animal fat with vegetable oil. The redness (a*) values changed significantly within treatments. Our results were in agreement with Youssef and Barbut (2011) who found that pre-emulsified oil (using soy protein isolate) resulted in a significant reduction in redness of comminuted beef product. Our results were also in agreement with Rindhe et al. (2018) who observed decrease in redness values of spent hen nuggets incorporated with hydrated wheat bran. The lightness (L*) and yellowness (b*) increased with the per cent replacement of animal fat. Similar results were also found by Yasarlar et al. (2007) for Turkish meat balls incorporated with cereal bran. Yilmaz (2005) observed increase in lightness values of low fat meat balls and Ahmad *et al.* (2021) observed decrease in both redness as well as yellowness value in restructured buffalo meat fillets during aerobic storage.

Table 5: Effect of fat replacement on colour parameters of Rista (Mean ± S.E.)

Parameters	Treatments					
	T_c	M_0	M_1	M_2	M_3	Total
L*	24.89 ± 0.05^{a}	26.62 ± 0.01^{b}	27.10 ± 0.10^{c}	28.11 ± 0.06^{d}	38.84± 0.02^{e}	29.11 ± 1.32
a*	5.95 ± 0.03^{d}	5.20 ± 0.01^{b}	5.52 ± 0.01^{c}	5.16 ± 0.03^{c}	4.19 ± 0.01^{a}	5.20 ± 0.15
b*	48.36 ± 0.01^{a}	69.90 ± 0.05^{b}	74.66 ± 0.02^{e}	80.78 ± 0.01^{c}	73.52 ± 0.01^{d}	69.44 ± 2.96

Mean ± S.E with different superscripts differ significantly

CONCLUSION

The cumbersome traditional method of *Rista* making can be successfully replaced with machines such as meat mincer and bowl chopper to save time and energy with hygienic conditions. It was seen that the quality parameters remained within the acceptable limits up to M_2 treatment, suggesting that 50% of animal fat can be replaced with vegetable fat without affecting the quality of *Rista.* It was concluded that the unhealthy animal fats can be reduced in the formulation to make the product healthier.

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