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Development and Analysis of Proximate Composition and Anti-oxidant Activity in Traditional and Modified Pork Vorta (*Wahan Mosdeng*)

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ABSTRACT

Background: *Wahan Mosdeng* is a freshly served traditional Tripuri dish, made with pork. This present study was conducted to establish an alternative form of *Wahan Mosdeng* with high shelf-life.

Methods: Modified product was prepared by boiling the uniform 1.5-2 cm meat along with fatty tissue cut, in the presence of common salt, ginger, turmeric powder, with further addition of 1% vinegar, 2.5% solution of potassium sorbate and 75 µg/g of nisin. Prepared products were stored in refrigeration and frozen temperature separately. Different proximate composition and Anti-oxidant activity were evaluated to get the differential picture between the target and the traditional product.

Result: Modified product showed better result in all the proximate parameter as well as in anti-oxidant activity was also higher in modified pork vorta (*Wahan Mosdeng*) in both refrigeration and frozen temperature. Collectively alternative form of *Wahan Mosdeng* recorded superior quality and also highly acceptable even after 15 days of refrigeration storage and 30 days of frozen storage sample.

Key words: Fat, Protein, Wahan mosdeng (Pork Vorta).

INTRODUCTION

Wahan mosdeng popularly known as Pork vorta/ *Suor Vorta* is widely consumed meat product of Tripura, usually prepare with pork and few condiments (Hoque and Taufique, 2019). This traditional Tripuri dish, mostly consumed in household and family functions requires minimal ingredients for procuring, recently it have emerged as a leading meat dish sold in small and medium sized restaurants as well as street-food vendors of Tripura. In Kokborok language, '*Wahan'* refers to pork and '*Mosdeng*' refers to 'mashed food'. Extremely low shelf-life of this product makes it strictly a freshly serve local dish. Whereas with minute addition of natural and chemical ingredients, it is presumed to be possible to make this an easily marketable product with relatively high shelf-life. This present study was conducted to develop a modified form of *Wahan Mosdeng* with a comparatively high shelf-life then the traditional one.

MATERIALS AND METHODS

Preparation of *Wahan mosdeng* (Pork vorta)

Traditional *Wahan mosdeng* (boiled pork chunks) was prepared by traditional method (*i.e* by boiling of both muscular and fatty tissue of pork and meat cut will (preferably 1.5-2 cm in size), in the presence of common salt and ginger for 15 mins Further cooking without lid till the water evaporates).

Modified *Wahan Mosdeng* (MWM) preparation is comparatively same as TWM but slight modification was done during preparation of MWM. *i.e*, by boiling the uniform 1.5-2 cm meat along with fatty tissue cut, in the presence of common salt, ginger, turmeric powder for 15 minutes and further cooking without lid till the water evaporates. It will be then oven dried for 1 hour. Thereafter, 1% vinegar will be added. Then it will be dipped inside 2.5% solution of potassium sorbate and 75 µg/g of nisin will be sprayed uniformly over the meat Table 1.

Allotment of product samples to different treatment groups

- **Treatment-1 (R1):** Traditional *Wahan Mosdeng*+Aerobic packaging in food graded packet+Storage in refrigeration temperature (4±1°C).

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- **Treatment-2 (R2):** Traditional *Wahan Mosdeng*+Aerobic packaging in food graded packet+Storage in frozen temperature (-18 to -22°C).
- **Treatment-3 (F1):** Modified *Wahan Mosdeng*+Aerobic packaging in food graded packet+Storage in refrigeration temperature (4±1°C).
- **Treatment-4 (F2):** Modified *Wahan Mosdeng*+Aerobic packaging in food graded packet+Storage in frozen temperature (-18 to -22°C).

Determination of the keeping-quality of *Wahan Mosdeng*

Proximate composition

Moisture, protein and fat was estimated for all the samples by following the methods described by AOAC (1995) method on every 8 days interval up to 16 days for refrigeration storage sample and 0 and 30 day for frozen storage product sample.

Estimation of antioxidant activity

The antioxidant activity of traditional and MWM was evaluated by the DPPH free radical scavenging assay and ferric reducing antioxidant potential (FRAP) assay method. DPPH free radical scavenging assay The scavenging activity of free radical was evaluated by the DPPH (1,1- Diphenyl-2-picrylhydrazyl) by the method of (Leong and Shui, 2002). For this, 0.1 mM DPPH solution prepared in methanol and initial absorbance measured in the spectrophotometer at 517 nm. After that, 40 µl extract was taken from the sample and added with 3 ml of that DPPH solution and measure the absorbance in different time interval until that absorbance become constant. Low absorbance of that reaction mixture indicates higher scavenging activity of free radicals and vice versa. By the using of Trolox (250-1250 µg/ml) standard curve was prepared and the scavenging ability of free radicals from that extracts, expressed as mg Trolox equivalent (TE) per gram of that extract.

Ferric reducing antioxidant potential assay (FRAP)

The FRAP assay was carried out by the method described by (Benzie and Strain, 1999). At first, 50 µl extract from sample was added with the 3 ml of FRAP reagent (FRAP reagent is the mixture of the-10 parts 300 mM sodium acetate buffer at pH 3.6, TPTZ 1 part and 20 mM Ferric chloride solution 1 part). After that, incubate the reaction mixture at 37°C for 30 min and there is an increase in absorbance which was measured under spectrophotometer at 593 nm. By the using of Trolox (250-1000 µg/ml) standard curve was prepared and the result are expressed as mg Trolox equivalent (TE) per gram of meat sample.

Statistical analysis

The data obtained through these experiments were statistically analyzed by the method of (Snedecor and Cochran, 1995) using SPSS version 20.

The significant values in the ANOVA were further tested through Duncan multiple range test. Results are depicted as mean±S.E and when $p<0.05$, $p<0.01$ and $p= 0.00$ then the differences were considered significant.

RESULTS AND DISCUSSION

The experiment was conducted in four treatment groups and the data were collected under different storage days in refrigeration and frozen storage. The obtained results from these experiments are presented below:

Proximate composition

Moisture

Under refrigeration storage, the moisture percentage were evaluated on 8 days and 16 days of storage. The mean values of moisture content on refrigeration storage for R1 and R2 sample on day 8 was 43.66±0.21 and 43.36±0.25 respectively. Moisture content for all the sample was gradually decreases with the increasing of storage periods (Table 2).

Statistically highly significant ($p<0.01$) difference was observed in moisture percentage for both R1 and R2 sample between 8 days and 16 days of storage periods but there was a non- significant difference was observed in between the sample.

In frozen storage it is also noticed that moisture percent was gradually decreases with the increasing of storage periods but loss of moisture was more in F2 sample as compare with F1 sample (Table 3).

In F1 sample moisture percentage non-significantly ($p>0.05$) decreased from 51.33±0.21 (D0) to 51.01±0.40 (D30) while in F2 sample moisture percentage significantly ($p<0.01$) decreased from 50.90±0.17 (D0) to 47.94±0.27(D30) with the increasing of storage periods.

Anandh and Lakshmanan (2010) also noticed that gradually decreasing of moisture content during refrigeration storage of smoked buffalo tripe rolls and also concluded that the moisture content decreases during storage because of dehydration of product by the permeable flims. Jin *et al*. (2010) also found the similar results in dry cured pork neck.

Protein

In case of R1 sample protein content was non-significantly ($p>0.05$) increases from 21.04±0.40 (D8) to 22.11±0.36 with the increasing of storage periods and for R2 sample protein content was increased significantly ($p<0.01$) from 21.47±0.33 (D8) to 22.80±0.33 (D16) during storage (Table 4).

Statistically a non-significantly ($p>0.05$) increasing trends in frozen storage of both F1 and F2 sample was observed with the increasing of storage periods (Table 5). The mean protein value of TWM and MWM was significantly ($p<0.01$) different on 0 day among the treatment. Also there was a highly significant ($p<0.01$) difference observed in between the sample in 12 days of storage.

Similar finding was also reported by the Kumar and Radhakrishnan (2006) significant increase of protein content in cured and smoked broiler chicken.

Fat

Under refrigeration storage fat percentage of R1 and R2 sample was estimated on 8 day and 16 days of storage

Table 1: Ingredient used during formulation of TWM and MWM.

Ingredient	TWM	MWM
Meat cut along with fatty tissue	1000 gm	1000 gm
Common salt	2%	2%
Ginger	6%	6%
Turmeric powder	-	2%
Vinegar	-	1%
Potassium Sorbet	-	2.5% solution
Nisin	-	75 ug/gm

Table 2: Moisture % of traditional and modified *Wahan Mosdeng* kept under refrigeration storage at 4±1°C on (Mean±S.E).

Moisture	Period of storage (D)		t value
	D-8	D-16	
R1	43.66±0.21	42.43±0.27	5.33**
R2	43.36±0.25	42.25±0.29	3.14**
t value	0.88^{NS}	0.45 ^{NS}	

n=6, **Significant at 1% (p<0.01), *Significant at 5% (p<0.05), NS-Non-significant.

Table 3: Moisture % of traditional and modified *Wahan Mosdeng* kept under frozen storage at -18 to -22°C (Mean±S.E).

Moisture	Period of storage (D)		F value
	D-0	D-30	
F1	51.33±0.21	51.01±0.40	0.85^{NS}
F2	50.90±0.17	47.94±0.27	9.01**
t value	1.55^{NS}	6.31**	

n=6, **Significant at 1% (p<0.01), *Significant at 5% (p<0.05), NS-Non-significant.

Table 4: Protein% of traditional and modified *Wahan Mosdeng* kept under refrigeration storage at 4±1°C (Mean±S.E).

Protein	Period of storage (D)		t value
	D-8	D-16	
R1	21.04±0.40	22.11±0.36	1.86^{NS}
R2	21.47±0.33	22.80±0.33	4.11**
t value	0.82^{NS}	0.44^{NS}	

n=6, **Significant at 1% (p<0.01), *Significant at 5% (p<0.05), NS-Non-significant.

Table 5: Protein% of traditional and modified *Wahan Mosdeng* kept under frozen storage at- 18 to -22°C (Mean±S.E).

Protein	Period of storage (D)		F value
	D-0	D-30	
F1	23.08±0.34	23.61±0.30	1.46^{NS}
F2	24.85±0.50	25.64±0.35	1.66^{NS}
t value	2.88**	4.29**	

n=6, **Significant at 1% (p<0.01), *Significant at 5% (p<0.05), NS-Non-significant.

periods. On the basis of mean value of fat percentage in R1 sample non-significantly (p>0.05) decreasing of fat value was observed from 30.09±0.31 to 29.75±0.38 from day 8 to day 16 days of storage. In R2 sample, fat value was also non-significantly decreases (p>0.05) 30.69±0.23 to 30.51±0.19 from day 8 to day 16 days of refrigeration storage (Table 6).

There was also a non-significant (p>0.05) different was observed in between the sample in 8 day and 16 days of storage periods. The mean fat percentage was non-significantly higher in R2 sample then the R1 sample during the storage periods.

In frozen storage fat value of F1 sample was non-significantly (p>0.05) decreases from 20.11±0.18 (D0) to 19.53±0.24 (D30) with the increasing of storage periods but in case of F2 sample fat value was decreases significantly (p<0.01) from 21.51±0.38 to 19.71±0.19 from 0 day and 30 days of storage periods respectively (Table 7).

In 0 day a non- significant (p>0.05) difference was observed in between the samples but in 30 days of storage periods highly significant (p<0.01) difference was observed in between the samples.

Similar findings were also reported by the Huang *et al*. (2011) in Chinese-style sausages (Reddy *et al*., 2012) in low fat chicken sausag.

Anti-oxidant activity

Anti-oxidant activities of modified and traditional *Wahan Mosdeng* were evaluated by the DPPH and FRAP methods and the anti-oxidant activity was expressed in mg Trolox equivalent (TE) per gram of that extract.

Anti-oxidant activity by DPPH methods

Anti-oxidant activity of refrigeration storage sample R1 and R2 was evaluated on 1 and 16 days of storage periods. With the advancement of storage periods anti-oxidant activity was decreased significantly (Table 8).

In case of R1 sample antioxidant activity was decreased significantly (p<0.01) from 0.56±0.003 (D1) to 0.11±0.03 (D16) but in case of R2 sample anti-oxidant activity was decreased statistically Non-significantly (p>0.05) from 0.69 ±0.10 (D1) to 0.33±0.02 (D16) with the increasing of storage periods.

In between R1 and R2 sample Non- significant (p>0.05) difference was observed on 1st day and highly significance (p<0.01) difference was observed on 16th days of storage sample for the anti-oxidant activity.

Anti-oxidant activity of frozen storage sample F1 and F2 was evaluated on 0 and 30 days of storage periods. With the advancement of storage periods anti-oxidant activity was decreased significantly (Table 9).

In case of F1 sample antioxidant activity was decreased significantly (p<0.01) from 0.63±0.03 (D0) to 0.17±0.11 (D16) but in case of R2 sample anti-oxidant activity was decreased statistically Non-significantly (p>0.05) from 0.71±0.02 (D0) to 0.35±0.02 (D30) with the increasing

of storage periods. In between F1 and F2 sample non-significant ($p>0.05$) difference was observed on 0 day and highly significance ($p<0.01$) difference was observed on 30th days of storage sample for the anti-oxidant activity.

Anti-oxidant activity by FRAP methods

Anti-oxidant activity of refrigeration storage sample R1 and R2 was evaluated on 1 and 16 days of storage periods. With the advancement of storage periods anti-oxidant activity was decreased significantly (Table 10).

Table 6: Fat% of traditional and modified *Wahan Mosdeng* kept under refrigeration storage at 4±1°C (Mean±S.E).

Fat	Period of storage (Days)		F value
	D-8	D-16	
R1	30.09±0.31	29.75±0.38	0.98^{NS}
R2	30.69±0.23	30.51±0.19	0.59^{NS}
t value	1.51^{NS}	1.75^{NS}	

n=6, **Significant at 1% ($p<0.01$), *Significant at 5% ($p<0.05$), NS-Non-significant.

Table 7: Fat% of traditional and modified *Wahan Mosdeng* kept under frozen storage at -18 to -22°C (Mean±S.E).

Fat	Period of storage (Days)		F value
	D-0	D-30	
F1	20.11±0.18	19.53±0.24	1.32^{NS}
F2	21.51±0.38	20.71±0.19	1.58^{NS}
t value	1.87^{NS}	1.73^{NS}	

n=6, **Significant at 1% ($p<0.01$), *Significant at 5% ($p<0.05$), NS-Non-significant.

Table 8: Anti-oxidant activity of traditional and modified *Wahan Mosdeng* kept under refrigeration storage at 4±1°C (Mean±S.E) by the DPPH methods.

DPPH	Period of storage (Days)		T value
	D-1	D-16	
R1	0.56±0.003	0.11±0.03	17.13**
R2	0.69±0.10	0.33±0.02	3.55^{NS}
t value	1.27^{NS}	6.52**	

n=6, **Significant at 1% ($p<0.01$), *Significant at 5% ($p<0.05$), NS-Non-significant.

Table 9: Anti-oxidant activity of traditional and modified *Wahan Mosdeng* kept under frozen storage at -18 to -22°C (Mean±S.E) by the DPPH methods.

DPPH	Period of storage (Days)		T value
	D-0	D-30	
F1	0.63±0.03	0.17±0.11	3.55**
F2	0.71±0.02	0.35±0.02	10.30^{NS}
t value	2.45^{NS}	1.5**	

n=6, **Significant at 1% ($p<0.01$), *Significant at 5% ($p<0.05$), NS-Non-significant.

Table 10: Anti-oxidant activity of traditional and modified *Wahan Mosdeng* kept under refrigeration storage at 4±1°C (Mean±S.E) by the FRAP methods.

Frap	Period of storage (Days)		T value
	D-1	D-16	
R1	0.08±0.001	0.0006±0.0001	49.63**
R2	0.09±0.001	0.0043±0.002	38.43**
t value	1.78^{NS}	1.87^{NS}	

n=6, **Significant at 1% ($p<0.01$), *Significant at 5% ($p<0.05$), NS-Non-significant.

Table 11: Anti-oxidant activity of traditional and modified *Wahan Mosdeng* kept under frozen storage at -18 to -22°C (Mean±S.E) by the FRAP methods.

Frap	Period of storage (Days)		T value
	D-0	D-30	
F1	0.08±0.002	0.0007±0.0002	64.59**
F2	0.09±0.01	0.002±0.0003	60.15**
t value	1.20^{NS}	3.13*	

n=6, **Significant at 1% ($p<0.01$), *Significant at 5% ($p<0.05$), NS-Non-significant.

In case of R1 and R2 sample antioxidant activity was decreased significantly ($p<0.01$) from 0.08±0.001 (D1) to 0.0006±0.0001 (D16) and from 0.09±0.001to 0.0043±0.002 respectively.

In between R1 and R2 sample Non- significant ($p>0.05$) difference was observed on 1st day and 16th days of storage periods.

Anti-oxidant activity of frozen storage sample F1 and F2 was evaluated on 0 and 30 days of storage periods. With the advancement of storage periods anti-oxidant activity was decreased significantly (Table 11). In case of F1 and F2 sample antioxidant activity was decreased significantly ($p<0.01$) from 0.08±0.002 (D0) to 0.0007±0.0002 (D30) and from 0.09±0.01 (D0) to 0.002±0.0003 (D30) respectively.

In between F1 and F2 sample Non- significant ($p>0.05$) difference was observed on 0 day and significant difference ($p<0.01$) 30th days of storage periods.

Similar finding was also observed by Fasseas *et al.* (2008) in bovine and porcine meat.

CONCLUSION

Taking into account the overall outcome and results obtained in the study, it can be concluded that addition of turmeric powder and other chemical preservatives in the modified form of ready-to-eat Wahan Mosdeng was developed successfully. MWM has superior quality in proximate composition, anti-oxidant activity and acceptable even after 15 days of refrigeration storage and 30 days of frozen storage.

Conflict of interest

All authors declare that they have no conflict of interest.

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