



Optimization of dandelion (*Taraxacum officinale*) leaf powder for the development of functional chicken meat loaves

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ABSTRACT

Locally available natural sources like dandelion (*Taraxacum officinale*), being rich source of functional ingredients can be exploited for their functional role by incorporating them in chicken meat loaves. Hence, a study was designed to evaluate the effect of incorporation of oven-dried Dandelion Leaf Powder (DLP) at three levels 1% (T₁), 2% (T₂) and 3% (T₃) replacing lean meat in the formulation of the product. Cooking yield of chicken meat loaves showed a non-significant ($P>0.05$) increase with increase in levels of DLP. pH values increased non-significantly ($P>0.05$) among the treatment groups, with increase in levels of DLP. The percent moisture showed a non-significant ($P>0.05$) increase whereas the percent protein as well as fat content showed a non-significant ($P>0.05$) decrease among all the treatments including control. The percent ash content of 2% and 3% level was significantly ($P<0.05$) higher than control whereas a non-significant ($P>0.05$) difference was found between control and 1% level. The antioxidant activity in terms of DPPH-RSA value showed a significant ($P<0.05$) increase with increase in levels of Dandelion leaf powder and was higher at 3% DLP incorporation. Sensory evaluation of the products revealed a non-significant ($P>0.05$) difference in various attributes of control and all the other treatments. Thus, it was concluded that dandelion leaf powder up to 1% level can be efficiently incorporated in chicken meat loaves for improving their functional value.

Key words: Dandelion, DPPH-RSA, functional, loaves, TBARS

The rapid lifestyle changes and enhanced socio-economic conditions have led individuals to develop preference for ready-to-eat meals (Ahmad *et al.* 2017). People find it more convenient to consume such food items that delight the taste buds more than traditional meals, consequently contributing to the rise of numerous lifestyle related health issues (Sajad *et al.*, 2024). As a result, there is an increasing consumer demand for producing healthy food options. The meat industry of India is also embracing the change passionately and producing many ready-to-eat non-vegetarian foods. However, the meat products are liable to chemical as well microbiological deterioration and hence require certain functionality to enhance their shelf life. The synthetic as well as natural alternatives could be used for enhancing the product shelf-life but the shift in consumer preference towards natural ingredients instead of synthetic alternatives has created new opportunities for various food industries, including the meat sector globally, to innovate

functional foods using natural and safe non-meat components, such as antioxidants (Chisti *et al.*, 2025). Hence, functional foods which are manufactured by restructuring the conventional foods by adding various natural functional ingredients have come into existence. Plants of the genus *Taraxacum* have long been used as medicinal herbs. The first reference to its application is reflected in its name, which is derived from the Greek word “taraxis” for inflammation and “akeomai” for curative. Dandelion (*Taraxacum officinale*) possesses many health benefits as it is anti-hyperglycemic, anti-inflammatory, anti-diabetic, anti-microbial, hypolipidemic, immunostimulatory and anti-oxidative (Wringo *et al.*, 2016; Fan *et al.*, 2023). Furthermore, it contains sesquiterpenoids, phenolic compounds, essential oils saccharides, flavonoids, sphingolipids, triterpenoids, sterols, coumarins, etc (Di-Napoli and Zucchetti, 2021). Keeping in view the above-mentioned facts, the study was devised with the objective of exploring the feasibility of using oven-dried Dandelion Leaf Powder (DLP) on quality characteristics of chicken meat loaves.

MATERIALS AND METHODS

Preparation of oven-dried dandelion leaf powder (DLP): Fresh/sun-dried dandelion (*Taraxacum officinale*) leaves were procured from the local market after which they were oven-dried at 60 °C for 3 hours. Oven-dried dandelion (*Taraxacum officinale*) leaves were ground to fine powder in an electric grinder and then stored in plastic containers for further use (Barimah *et al.*, 2017).

Preparation of chicken loaves: The study was conducted in the Division of Livestock Products Technology, Faculty of Veterinary Sciences and Animal Husbandry, SKUAST-Kashmir.

Live chicken (broiler) were procured from the local market. After proper rest and ante-mortem examination, they were slaughtered in the Experimental Slaughter Hall of the Division of Livestock Products Technology by Halal method. The dressed chicken were deboned manually and chilled overnight before use or were stored in frozen condition until used. Lean meat obtained from broiler chicken was minced in a mincer (MSW-627) with 4 mm plate. Meat emulsion for broiler chicken meat loaves was prepared in Bowl Chopper (SCHARFEN, Germany). Minced meat was loaded in the bowl chopper, wherein salt along with half of chilled water was added for better extraction of salt soluble proteins.



Fig 1: *Taraxacum officinale* (Scientific name) Dandelion (Common name) Haend (Local name in Kashmir) Family: Asteraceae (Compositae)

The chopping was done for 2 minutes. After that vegetable oil was gradually added and chopping continued for another 2 minutes. This was followed by addition of whole egg liquid, dry spice mix and condiment paste (onion: garlic: ginger = 3:2:1). The contents were again chopped for 1 minute to get the proper emulsion. This formulation served as control. Throughout the preparation, the Dandelion Leaf Powder (DLP) at different levels 1%, 2%, 3% was added by replacing lean meat from the basic formulation of the product (Table 1). The emulsion prepared was then weighed and filled in stainless steel moulds. Moulds were covered with lid and tied

with thread and cooked in hot water (90 °C) for 35 minutes to an internal temperature of around 80 °C (Sajad *et al.*, 2024). The internal temperature of loaves was monitored by a thermometer. All the three treatments of chicken meat loaves viz., T₁, T₂ and T₃ having 1, 2 and 3 percent DLP along with control (T₀) were assessed for various parameters viz., cooking yield (%), pH, moisture (%), protein (%), fat (%), ash (%), DPPH-RSA and sensory characteristics. The optimum level of DLP (1%) was selected on the basis of overall quality of the product. The experiment was repeated thrice.

Table 1: Basic formulation of loaves

Ingredients	Quantity (w/w) per 100 g for T ₀ (control)	
Lean meat	78.0	Dandelion Leaf Powder (DLP) at different levels viz. 1% (T ₁), 2% (T ₂) and 3% (T ₃) was added by replacing lean meat from the basic formulation
Chilled water	10.0	
Vegetable oil	5.0	
Condiment paste	3.0	
Whole egg	2.0	
Salt	1.0	
Dry spice mix	1.0	

Analytical procedures: The pH of chicken meat loaves was determined by the method of Trout *et al.* (1992) by using digital pH meter (Model EE-011, Tanco Laboratory Equipments Ltd. India). The weight of chicken meat loaves was recorded before and after cooking and the cooking yield was expressed in percentage. The percentage moisture, protein, ether extract and ash content of the product samples were evaluated as per standard procedure of Association of Official Analytical Chemists (AOAC, 2019). The DPPH assay was done according to the method of Brand-Williams *et al.* (1995) with some modifications.

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, texture, juiciness, saltiness, mouth coating, and overall acceptability as per 8-point descriptive scale, where 8 is extremely desirable and 1 is extremely undesirable (Keeton, 1984). The samples were suitably warmed before serving to the panelists (Fig 2).



Fig 2: Sensory evaluation of chicken loaves

Statistical analysis: The statistically analyzed results have been interpreted and tabulated. The results were analyzed and tabulated statistically by ANOVA using SPSS software. The results were expressed as Mean $\pm$ S.E at 5% level of significance (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

Physico-chemical properties: The mean values for various physico-chemical properties of dandelion leaf powder incorporated chicken meat loaves are presented in Table 2.

Table 2: Physico-chemical properties of chicken meat loaves containing various levels of oven-dried Dandelion Leaf Powder (n=3)

Parameters	Oven-dried Dandelion Leaf Powder			
	T ₀	T ₁	T ₂	T ₃
Cooking yield (%)	84.91 $\pm$ 1.65 ^a	85.86 $\pm$ 1.33 ^a	86.83 $\pm$ 1.89 ^a	87.95 $\pm$ 1.76 ^a
pH	6.16 $\pm$ 0.03 ^a	6.23 $\pm$ 0.03 ^{ab}	6.26 $\pm$ 0.03 ^b	6.29 $\pm$ 0.03 ^b
Moisture (%)	69.89 $\pm$ 0.70 ^a	70.06 $\pm$ 0.34 ^a	70.44 $\pm$ 0.22 ^a	70.47 $\pm$ 0.31 ^a
Protein (%)	17.59 $\pm$ 0.38 ^a	17.36 $\pm$ 0.30 ^a	17.23 $\pm$ 0.13 ^a	17.07 $\pm$ 0.22 ^a
Fat (%)	6.62 $\pm$ 0.06 ^a	6.60 $\pm$ 0.04 ^a	6.58 $\pm$ 0.03 ^a	6.56 $\pm$ 0.02 ^a
Ash (%)	0.88 $\pm$ 0.16 ^a	1.32 $\pm$ 0.06 ^{ab}	1.74 $\pm$ 0.07 ^{bc}	1.78 $\pm$ 0.24 ^c

Values expressed are mean $\pm$ standard deviation.

Means in the row with different lowercase superscripts are significantly different at $p < 0.05$

There was a non-significant ($P > 0.05$) increase in the cooking yield with the increase in the levels of DLP (Table 2). The increase in cooking yield with DLP addition can be attributed to improvement of the hydration and binding properties of the product. The results were in agreement with Turhan and Sagir (2005) who reported better cooking yield of beef burgers upon the addition of hazelnut pellicle. Talukder *et al.* (2014) found better cooking yield of restructured chicken meat block incorporated with the increasing levels of lotus root powder. Reshi (2016) found that cooking yield of spent hen meat sausages increased with the increase in incorporation of lotus stem powder. The pH value of control was significantly ($P < 0.05$) lower than 2% and 3%, and non-significantly ($P > 0.05$) lower than 1% dandelion leaf powder incorporated chicken loaves (Table 2). Among the treatment groups, pH values increased non-significantly ($P > 0.05$) with increase in levels of DLP. The slight increase in the pH values by the addition of Dandelion Leaf Powder might be attributed to somewhat higher pH (around 6.5) of the dandelion leaves as compared to the raw lean meat (around 5-6). The results were in agreement with Qureshi *et al.* (2018) who reported that the addition of fenugreek seed powder and its extract to spent hen meat patties caused slight but not significant increase in the pH values of chicken patties. Moisture content of all the chicken meat loaves incorporated with Dandelion Leaf Powder showed a non-significant ($P > 0.05$) increase when compared to control (Table 2). Moisture percentage showed an increasing trend with the increasing DLP levels in comparison to control products, which might be due to increasing water retention with the increase in level of the Dandelion Leaf powder. Talukder *et al.* (2014) found improved moisture content of chicken meat blocks with the increase in the level lotus root powder. Qureshi *et al.* (2018) reported a non-significant increase in the moisture content of spent hen meat patties with increasing incorporation of fenugreek seed powder. Protein content of all the chicken meat loaves incorporated with Dandelion Leaf Powder showed a non-significant ($P > 0.05$) decrease when compared to control (Table 2). The decreasing trend in the protein content of the product could be attributed to a slightly lower protein content of dandelion leaves as compared to the lean meat (replaced in place for DLP in the product formulation). Talukder *et al.* (2014) found decreased protein content of chicken meat blocks with

the increase in the levels of lotus root powder. Rovida (2016) also reported decrease in the protein content of mutton nuggets incorporated with increasing levels of walnut kernel paste and saffron petal powder. Fat content of all the chicken meat loaves incorporated with Dandelion Leaf Powder showed a non-significant ($P>0.05$) decrease when compared to control (Table 2). The lower fat content of DLP could be the reason for the decrease in fat content of the product. Talukder *et al.* (2014) found decreased fat content of chicken meat blocks with the increase in the levels of lotus root powder. The ash content improved only slightly up to 1% DLP addition (Table 2). The difference was significant ($P<0.05$) at 2% and 3% incorporation levels. The increasing trend of ash content with increase in the level of Dandelion Leaf Powder may be due to high levels of ash content of the dandelion leaves as also supported by Qureshi *et al.* (2016). The results were also in agreement with the findings of Kumari *et al.* (2015) who reported that the ash content of chicken patties showed a significantly ($P<0.05$) increasing trend with the increase in the level of Lungru (*Diplazium esculentum*). Qureshi *et al.* (2018) reported an increase in the ash content of spent hen meat patties incorporated with the increasing levels of Fenugreek Seed Powder.

Antioxidant activity: The mean values for anti-oxidant activity of dandelion leaf powder incorporated chicken meat loaves are presented in Table 3.

Table 3: Antioxidant activity of chicken meat loaves containing various levels of oven-dried Dandelion Leaf Powder (n=3)

Parameter	Oven-dried Dandelion Leaf Powder			
	T ₀	T ₁	T ₂	T ₃
DPPH-RSA	40.95±0.41 ^a	50.37±0.27 ^b	55.32±0.35 ^c	60.66±0.44 ^d

Values expressed are mean ± standard deviation.

Means in the row with different lowercase superscripts are significantly different at $p<0.05$

There was an increase in the DPPH-RSA values with increase in the levels of Dandelion Leaf Powder and a significant ($P<0.05$) increase was found at all levels from 1% DLP incorporation (Table 3). The increase in the values with increasing levels of Dandelion Leaf Powder might be attributed to the better antioxidant potential of phenolic rich dandelion leaves. Sheikh *et al.* (2015) conducted a study on the *in vitro* antioxidant activity, total phenolic and total flavanoid contents of *Taraxacum officinale* leaves and reported a huge antioxidant potential of the plant. Barimah *et al.* (2017) also concluded about the tremendous antioxidant potential of *Taraxacum officinale* leaves.

Sensory evaluation: The mean values for sensory evaluation of dandelion leaf powder incorporated chicken meat loaves are presented in Table 4.

Table 4: Sensory evaluation of chicken meat loaves containing various levels of oven-dried Dandelion Leaf Powder (n=21)

Sensory attributes	Oven-dried Dandelion Leaf Powder			
	T ₀	T ₁	T ₂	T ₃
Appearance	7.95±0.11 ^c	7.90±0.07 ^c	6.86±0.14 ^b	6.29±0.21 ^a
Flavour	7.24±0.19 ^c	7.33±0.13 ^c	6.48±0.18 ^b	5.90±0.18 ^a
Texture	7.10 ±0.23 ^a	7.67 ±0.14 ^a	7.19 ±0.20 ^a	7.10±0.21 ^a
Juiciness	6.95±0.05 ^{bc}	7.19 ±0.11 ^c	6.67±0.11 ^{ab}	6.43±0.18 ^a
Saltiness	7.24±0.12 ^{ab}	7.43±0.15 ^b	6.90±0.21 ^{ab}	6.76±0.26 ^a
Mouth-coating	7.10±0.17 ^a	7.29±0.14 ^a	6.71±0.27 ^a	6.67±0.28 ^a
Overall acceptability	7.38±0.16 ^b	7.67±0.14 ^b	6.71±0.10 ^a	6.43±0.15 ^a

Values expressed are mean ± standard deviation.

Means in the row with different lowercase superscripts are significantly different at $p<0.05$

*8-point descriptive scale (8 = extremely desirable, 1 = extremely undesirable)

Organoleptic evaluation of the products revealed no significant differences in the various attributes between the control and dandelion leaf powder incorporated chicken meat loaves (Table 4). All of the sensory attributes showed a declining trend with increasing DLP incorporation, T_1 being non-significantly ($P>0.05$) higher than control for all attributes, except for appearance which was non-significantly ($P>0.05$) lower than control. Hegazy (2011) concluded that there was no significant difference in colour, taste, flavour and appearance scores of beef burger samples with 3 and 6 % Fenugreek Seed Flour (FSF) incorporation. Rovida (2016) reported organoleptic evaluation of the mutton nuggets revealed no significant differences in the various sensory attributes between the control and walnut kernel added nuggets.

CONCLUSION

Dandelion (*Taraxacum officinale*), leaf powder being a rich source of various functional ingredients can successfully be used for the development of functional meat products. Furthermore, based on various evaluation parameters (particularly sensory attributes) it was concluded that 1% Dandelion leaf powder is most suited for the development of functional chicken meat loaves.

CONFLIT OF INTEREST

All the authors affirm that there is no conflict of interest among them. All research activities comply with relevant legal, institutional and ethical standards.

AUTHOR CONTRIBUTION

All the authors contributed equally in the present study.

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