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Formulation and Quality Evaluation of Kadaknath Freeze Dried Meat Soup Powder Incorporated with Oat Flour and Mint Leaves Powder

Lokesh Tak[1]*, Basant Bais[1], Manisha Singodia[2] and Matin Ansari[3]

[1]Department of Livestock Products Technology, College of Veterinary and Animal Sciences, Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, INDIA
[2]Department of Veterinary & Animal Husbandry Extension Education, College of Veterinary and Animal Sciences, Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, INDIA
[3]ICAR-National Research Centre on Camel, Bikaner, Rajasthan, INDIA

**Corresponding author: L Tak; E-mail: lokesht.tak90@gmail.com*

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ABSTRACT

Indigenous/native breeds of chickens are playing an important role in rural economy in most of the developing countries. Among many native breeds Kadaknath is experiencing higher demand due to its unique characteristics and perceived health benefits of its meat. So, keeping this in view the present study was undertaken to formulate Kadaknath freeze dried meat soup powder incorporated with oat flour and mint leaves to enhance the functional property of Kadaknath meat and to analyze various quality parameters. The drying of minced meat was done by using freeze drier (Christ Alpha, Germany) at -65±5°C for 24 hours. The prepared meat powder was incorporated with Oat flour (*Avena sativa*), at three different levels including 10 %, 20 % and 30 % and the other ingredients like table salt, sugar, black pepper, citric acid, skim milk powder and guar gum were added at fixed proportions, in all treatments. The results of the study noted that the functional properties including ABTS activity, DPPH activity and total phenolic contents of the functional chicken soup powder were showing an increasing pattern with incorporation of higher proportion of oat flour as well as mint leaves powder, however hedonic scores were showing reduced values with higher amount of these ingredients.

HIGHLIGHTS

- Formulation and quality evaluation of Kadaknath freeze dried meat soup.
- The level of 20% oat flour and 2% mint leaves powder was best for development of functional chicken meat soup powder by using freeze dried Kadaknath meat.

Keywords: Functional Food, Kadaknath Meat, Freeze Dried Meat Powder, Antioxidant Activity

The poultry industry meets the majority of protein and nutrition needs. From a mere backward poultry farming that appears to be very quick, India's poultry industry has undergone an exemplary transformation in structure and activity over the last two decades, transforming into a mega-industry with a diverse workforce. Kadaknath is an important indigenous poultry breed. It has huge meat demand due to its unique black meat. It has more disease resistance and high meat and egg price with 14 week finisher poultry breed.

Meat provides a suitable environment for proliferation of meat spoilage microorganisms and common food-borne pathogens, therefore adequate preservation technologies must be applied in order to preserve its safety and quality. Meat powder is one of the best options to produce the shelf stable meat product.

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Functional foods should be enhanced with added ingredients not normally found in the product, providing health benefits beyond their nutritional value. Functional foods are intended to be consumed as part of the normal diet but offer the potential of enhanced health or reduced risk of disease.

Covering all the bases, a study was conducted on the topic "Formulation and quality evaluation of Kadaknath freeze dried meat soup powder incorporated with oat flour and mint leaves powder".

MATERIALS AND METHODS

Live kadaknath birds were procured from Poultry farm, CVAS, Bikaner as per the availability and were slaughtered in Meat Processing Laboratory of Department of Livestock Products Technology as per standard procedure. After manual deboning, the deboned meat was packed in LDPE film and kept at -18ºC till utilization. Oat flour, black pepper, table salt, skim milk powder, food grade citric acid, sugar, guar gum and packaging material were purchased from local market of Bikaner. Mint leaves were purchased from local market of Bikaner in fresh condition. After washing thoroughly, these leaves were further dried and further grinded and subsequently sieved to obtain the raw leaves powder. All the chemicals used in the study were of analytical grade and obtained from standard firms.

Experiment detail

Chicken meat powder was prepared from meat of and kadaknath by application of freeze drying technique. The meat of the birds was minced in meat mincer (Sirman, Italy). The minced meat was further placed in aluminium foil covered glass plates for drying using freeze drier (Christ Alpha, Germany) at -65±5°C for 24 hours. The dried meat was further grinded to make meat powder using a mixer grinder and subsequently sieved by passing through a sieve with a pore size of about 500µ to obtain the raw chicken meat powder.

First the prepared meat powder was incorporated with Oat flour (*Avena sativa*), at three different levels including 10%, 20 % and 30 %. The levels of dried meat powder and flour constitute 100 % of the composition of soup powder with other ingredients. The other ingredients like table salt, sugar, black pepper, citric acid, skim milk powder and guar gum were added to the above compositions at fixed proportions, in all treatments. All the treated products were packaged aerobically and kept at ambient temperature (27±2°C) and evaluated for different physico-chemical and sensory characteristics to select the best oat flour in development of functional chicken soup powder with its best level.

The selected best oat flour incorporated functional Kadaknath soup powder was taken for incorporation of mint leaves in powder form at three different concentrations viz. 1%, 2% and 3%. All the treated products were packaged aerobically and kept at ambient temperature (27±2°C) and evaluated for different physico-chemical and sensory characteristics to select the best mint leaves powder with its best concentration. Soup was prepared by adding water at 10 times the volume of ingredients.

Table 1: Composition of oat flour added functional chicken soup powder

Sl. No.	Ingredient	Percentage (%)	Percentage (%)	Percentage (%)
1	Kadaknath meat powder	50	60	70
2	Oat flour	30	20	10
3	Table salt	9	9	9
4	Black pepper	5	5	5
5	Sugar	3	3	3
6	Skim milk	1	1	1
7	Citric acid	1	1	1
8	Guar gum	1	1	1
	Total	**100**	**100**	**100**

Table 2: Composition of oat flour and mint leaves powder incorporated functional Kadaknath soup powder

Composition	Oat flour added functional Kadaknath soup powder	Mint Leaves powder	Total
Percentage (%)	99	1	100
Percentage (%)	98	2	100
Percentage (%)	97	3	100

ANALYTICAL PROCEDURES

pH

The pH was measured by a digital pH meter (Labman, LMPH-10).

Free fatty acid

Free fatty acid was estimated as per Koniecko (1979).

Bulk Density

The bulk density of the powder was determined by method provided by Yetismeyen and Deveci, (2000).

Water solubility and Water absorption capacity

Water solubility and Water absorption capacity was determined in accordance with method described by Anderson *et al.* (1969).

Oil absorption capacity

Oil absorption capacity was determined using the method described by Lin and Zayas (1987).

Foaming capacity

Foaming properties can be determined by following Miller and Groninger (1976).

ABTS radical scavenging activity

The spectrophotometric analysis of ABTS activity was determined according to method described by Salami *et al.,* (2009).

DPPH radical scavenging activity

The ability to scavenge 2, 2′-diphenyl-1-picrylhydrazyl (DPPH) radical by added antioxidants in samples was estimated following the method of Brand-Williams *etal.,* (1995).

Total phenol content

The total phenolic content was determined using method provided by Singleton *et al.* (1999).

Water activity

Water activity was measured with the help of a water activity meter (Rotronics, Switzerland).

Sensory evaluation

Sensory attributes of the products were evaluated by a panel consisting of minimum 6 semi-trained members using 8 point descriptive scale.

STATISTICAL ANALYSIS

Each trial was replicated thrice in duplicate (n=6). The data obtained in the study on various parameters were statistically analyzed. Duplicate samples were drawn for each parameter and the experiment was replicated thrice (n=6). Sensory evaluation was performed by a panel of seven member judges three times, so total observations being 21 (n=21) Data were subjected to analysis of variance, homogeneity test and Duncan's Multiple Range Test (DMRT) for comparing the means to find the effects between samples.

RESULTS AND DISCUSSION

Experiment 1: Physico-chemical and sensory properties of meat soup powder prepared by kadaknath freeze dried meat powder with different oat flour concentrations.

The Physico-chemical and sensory properties of meat soup powder prepared by kadaknath freeze dried meat powder with different oat flour concentrations has been presented in Table 3.

As per the findings given in results, increasing the level of oat flour causes raise in the pH of the preparations. Similar type of findings was founded for free fatty acid amount. The results show similar trends reported by Lee *et al.* (2017).

Oat flour have lower bulk density than bulk density of raw meat powder, which directly reflected that increasing the amount of oat flour for preparation of functional chicken soup powder causes lowering the bulk density of the preparation. The results show parity with Ibrahim *et al.* (2020).

Meat powder have higher amount of fat as compared to oat flour. Increasing the flour amount causes raise in water solubility. Meat has higher numbers of free protein bonds compare to oat flour causes more bindings with water molecules, hence higher protein amount causes more water absorption capacity. For oil absorption capacity, the findings were opposite due to lesser numbers of lipophilic bonds. Proteins contain long chains of amino acids that bind the particles inside them. When mixed in a shaker firmly, it causes a breakage of all the bonds between acids. Hence, these bonds then exposed to air causes foam bubbles to arise and cause foaming. Higher the protein causes more foaming capacity. The findings also represent that in process of functional chicken soup powder formulations, increasing the amount of oat flour causes lowering the foaming capacity. The results show parity with results of reported by Shah *et al.* (2016).

The antioxidant activity along with total phenolic content of functional chicken soup powder was increasesd with the increased amount of oat flour. The findings of present study show parity with the finding provided by Ibrahim *et al.* (2020); Shah *et al.* (2016).

Water activity of functional meat soup powder showed an increasing trend with increasing the amount of flour.

Sensory evaluation conducted based on 8 point Hedonic scale, have shown that products having 20% oat flour and 60% meat powder in formulation was most acceptable, hence this treatment was further taken for addition of mint leaves powder. The results were in line with the findings of reported by Ravichandran (2017).

With reference to the finding above mentioned, it was concluded that 20% oat flour was best rightfully incorporated in the procedure for development of functional chicken soup powder with oat flour, hence this treatment was further incorporated with mint leaves powder with three different concentrations.

Table 3: Physico-chemical and sensory properties of meat soup powder prepared by kadaknath freeze dried meat powder with different oat flour concentrations

Parameters	OF1	OF2	OF3	Treatment mean
pH	5.73±0.06	5.78±0.03	5.91±0.06	5.81±0.03
Free fatty acid (%)	0.35±0.002	0.36±0.002	0.36±0.002	0.36±0.001
Bulk density (g/ml)	0.63±0.01	0.61±0.02	0.58±0.01	0.61±0.01
Water solubility (w/w)	0.20±0.001	0.20±0.001	0.20±0.001	0.20±0.001
Water absorption capacity (w/w)	3.29^{b}±0.02	3.29^{ab}±0.03	3.27^{a}±0.02	3.29±0.01
Oil absorption capacity (ml/g)	1.78±0.01	1.79±0.01	1.79±0.01	1.79±0.003
Foaming capacity (%)	23.49±0.48	23.16±0.28	22.62±0.62	23.09±0.27
ABTS activity (% inhibition)	28.06±0.21	28.25±0.18	28.61±0.17	28.31±0.11
DPPH activity (% inhibition)	22.88±0.66	22.91±0.79	23.17±0.58	22.99±0.37
Total phenolic (Mg GAE/g)	0.68±0.01	0.69±0.01	0.71±0.01	0.69±0.01
Water activity (a_w)	0.24±0.02	0.25±0.01	0.26±0.01	0.25±0.01
Colour	7.28^{b}±0.12	7.65^{a}±0.15	6.71^{c}±0.12	7.21±0.10
Appearance	7.31^{b}±0.10	7.64^{a}±0.10	7.05^{c}±0.10	7.33±0.10
Flavour	7.07^{b}±0.10	7.26^{a}±0.10	6.49^{c}±0.10	6.94±0.10
Mouth coating	6.80^{b}±0.15	7.27^{a}±0.10	6.95^{b}±0.13	7.00±0.10
Meat flavour intensity	7.14^{b}±0.10	7.19^{a}±0.15	7.04^{b}±0.10	7.12±0.10
Consistency	6.83^{b}±0.10	7.15^{a}±0.10	6.82^{b}±0.15	6.93±0.09
Overall acceptability	6.74^{b}±0.10	7.44^{a}±0.10	7.25^{b}±0.10	7.14±0.10

Overall means bearing different superscripts in a row (a, b, c.....) differ significantly (P<0.05); **Note: OF1**- meat soup powder prepared by kadaknath freeze dried meat powder with 10 % oat flour, **OF2**- meat soup powder prepared by kadaknath freeze dried meat powder with 20 % oat flour, **OF3**- meat soup powder prepared by kadaknath freeze dried meat powder with 30 % oat flour.

Experiment 2: Physico-chemical and sensory properties of meat soup powder prepared by kadaknath freeze dried meat powder with 20% oat flour and different mint leaves powder concentrations

The results related to Physico-chemical and sensory properties of meat soup powder prepared by kadaknath freeze dried meat powder with 20% oat flour and different mint leaves powder concentrations have been represented in table 4.

Mint leaves have higher pH and lower free fatty acid value with compare to the selected treatment. So,incorporation of higher amount of mint causes increased pH values and decreasing trends in free fatty acid values. Higher level of mint causes low FFA values of the product, which were in line with the findings of Viji *et al.* (2015).

The findings for bulk density of functional chicken soup powders had shown slightly positive effect with incorporation of mint leaves powder. Incorporation of mint leaves causes increasing the values of bulk density of the formulations as mint leaves powder was more porous than functional chicken soup powders added with flour. These findings can be correlate with the findings of Kaur *et al.* (2008).

The results suggest that increasing the level of mint leaves powder causes reduction in water solubility, water absorption capacity and oil absorption capacity, which might be due to addition of mint leaves powder. Addition of the leaves powder can also reduces the water absorption capacity and oil absorption capacity due to insoluble and Impenetrable nature of cellulose. (Lindman *et al.,* 2010).

The insolubility of leaves powder can cause reduction of interfacial area, which directly reduces the foaming capacity. Similar findings were obtained in current study in which incorporation of higher level of leaves powder showed reduction pattern in foaming capacity of the product, which favours the findings of Gull *et al.* (2015).

Table 4: Physico-chemical and sensory properties of meat soup powder prepared by kadaknath freeze dried meat powder with 20% oat flour and different mint leaves powder concentrations

Parameters	ML1	ML2	ML3	Treatment mean
pH	5.79±0.05	5.79±0.03	5.81±0.03	5.80±0.02
Free fatty acid (%)	0.35±0.009	0.35±0.009	0.33±0.009	0.34±0.005
Bulk density (g/ml)	0.63±0.02	0.65±0.02	0.66±0.01	0.65±0.01
Water solubility (w/w)	0.20±0.001	0.20±0.001	0.20±0.001	0.20±0.001
Water absorption capacity (w/w)	3.26±0.04	3.24±0.04	3.20±0.04	3.23±0.02
Oil absorption capacity (ml/g)	1.78±0.01	1.77±0.01	1.77±0.01	1.77±0.01
Foaming capacity (%)	22.83±0.20	22.63±0.22	22.44±0.33	22.63±0.14
ABTS activity (% inhibition)	28.44±0.19	28.46±0.21	28.56±0.28	28.48±0.12
DPPH activity (% inhibition)	23.25±0.72	23.62±0.71	23.72±0.72	23.53±0.39
Total phenolic (Mg GAE/g)	0.70±0.02	0.72±0.01	0.75±0.02	0.72±0.01
Water activity (a_w)	0.21^{b}±0.01	0.21^{b}±0.01	0.24^{a}±0.01	0.22±0.01
Colour	6.37^{b}±0.10	7.47^{a}±0.15	7.29^{ab}±0.12	7.04±0.10
Appearance	6.38^{c}±0.10	7.42^{a}±0.20	7.05^{b}±0.10	6.95±0.10
Flavour	7.02^{b}±0.10	7.43^{a}±0.10	6.97^{b}±0.10	7.14±0.10
Mouth coating	6.69^{b}±0.20	7.14^{a}±0.12	6.71^{b}±0.15	6.84±0.09
Meat flavour intensity	7.20^{b}±0.10	7.26^{a}±0.15	6.29^{c}±0.10	6.84±0.09
Consistency	6.66^{b}±0.10	6.91^{a}±0.12	6.67^{b}±0.10	6.74±0.10
Overall acceptability	7.10^{b}±0.10	7.31^{a}±0.10	6.23^{c}±0.15	6.88±0.10

Overall means bearing different superscripts in a row (a, b, c....) differ significantly (P<0.05); **ML1**- meat soup powder prepared by kadaknath freeze dried meat powder with 20 % oat flour and 1% mint leaves powder, **ML2**- meat soup powder prepared by kadaknath freeze dried meat powder with 20 % oat flour and 2% mint leaves powder, **ML3**- meat soup powder prepared by kadaknath freeze dried meat powder with 20 % oat flour and 3% mint leaves powder.

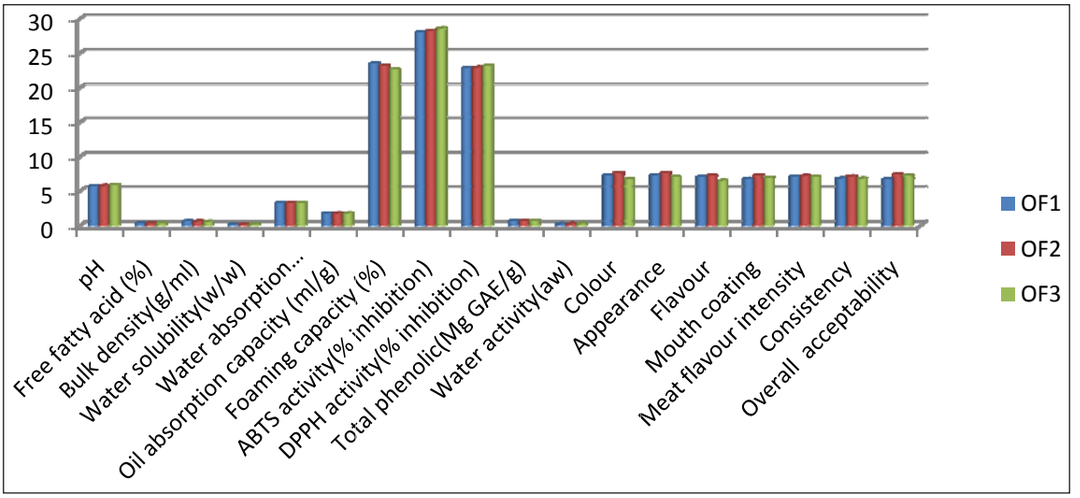

Fig. 1: Physico-chemical and sensory properties of meat soup powder prepared by kadaknath freeze dried meat powder with different oat flour concentrations

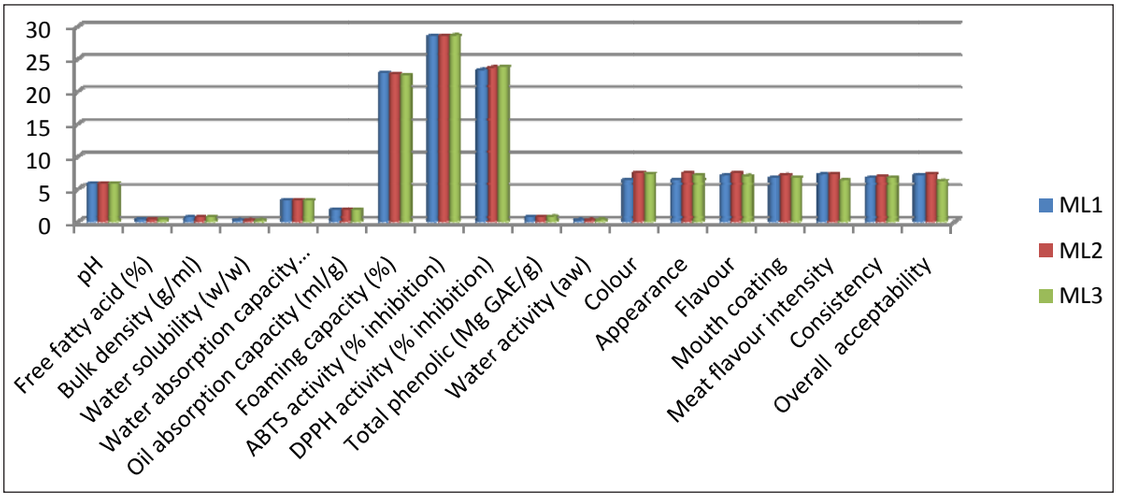

Fig. 2: Physico-chemical and sensory properties of meat soup powder prepared by kadaknath freeze dried meat powder with 20% oat flour and different mint leaves powder concentrations

The mint leaves powder has strong antioxidant activity; as increasing the level of mint leads to rise in antioxidant assay (both ABTS and DPPH activity). The result showed resemblance with the findings provided by Asghari *et al.* (2018).

The incorporation of mint leaves powder can cause increase in total phenolic of the product. These results correlate with the total phenol value of mint provided by Tahira *et al.* (2011).

Addition of mint leaves powder can directly cause increasing the water activity of functional chicken soup powder which shows a positive correlation with present study. The result showed parity with the findings provided by Noori *et al.* (2021).

The results of sensory attributes like colour and appear suggested that higher level of mint can causes higher intensities of mint colour. Higher mint also reduced the meaty flavour as mint provides strong aroma of its

components. The consistency scores of functional chicken soup powder also reduced with higher level of mint as it showed non solubility. Similar sensory attributes were founded by Latoch and Stasiak (2015).

The results from experiment 1 and 2 suggested that a level of 20% oat flour and 2% mint leaves powder was best for development of functional chicken meat soup powder by using freeze dried kadaknath meat.

CONCLUSION

The present study was done to formulate chicken meat soup powder using freeze dried kadaknath meat, oat flour,mint leaves powder, black pepper, table salt, skim milk powder, food grade citric acid, sugar and guar gum. The 20% level of oat flour found suitable in the process of formulation of chicken meat soup powder which further added with mint leaves powder. The 2% level of mint leaves powder was found suitable. Thus it is concluded that the level of 20% oat flour and 2% mint leaves powder was found best for formulation of chicken meat soup powder using freeze dried kadaknath meat and act as functional food.

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