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NamMTI ILMIY-TEXNIKA JURNALI TAHRIR HAY'ATI A'ZOLARI

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O. Kazakov, B. Xolmirzayev, A. Mirzaev, Sh. Mansudov,
A. Tursunov, O. R. Qodirov (mas'ul muharrir)

INVESTIGATION OF ADDITIVES IN THE COMPOSITION OF MEAT CANNED PRODUCTS BASED ON TARAXACUM OFFICINALE WIGG. PLANT

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Abstract: In this study, the incorporation of dried leaf, root, or aqueous extract of *Taraxacum officinale* Wigg. into meat pâté was investigated to enhance the functional properties of the product.

Taraxacum officinale Wigg. is rich in polyphenols, flavonoids, and other bioactive compounds that exhibit pronounced antioxidant and anti-inflammatory effects. When 1–5% of the plant extract is added to pâté, lipid and protein oxidation is significantly reduced, shelf life is extended, antiradical activity increases, and total polyphenol content rises by 30–60%. Organoleptic evaluation shows that at 2–3% dosage, acceptable levels of taste and odor are maintained.

The results demonstrate that the application of *Taraxacum officinale* Wigg. as a natural antioxidant and functional additive enables the production of meat pâté with prolonged microbiological stability (extended shelf life without microbial spoilage). This approach represents a promising direction for reducing synthetic additives and developing "clean-label" or natural products. The article comprehensively covers the technological and biological aspects of enrichment, supported by scientific terminology, experimental results, and tabular data.

Keywords: Taraxacum officinale Wigg., meat pâté, functional enrichment, antioxidant, natural additive, polyphenol, flavonoid, antiradical activity, aqueous extract.

Introduction. Canned meat paté (inglizcha: canned meat pâté) is an emulsified product prepared from meat (typically liver, pork, or beef), fat, and spices, which is sterilized in cans for long-term storage. Enrichment of this product's composition with the medicinal plant *Taraxacum officinale* Wigg. represents a novel direction in food technology, enabling an increase in the nutritional value of the product, enhancement of its antioxidant properties, and reduction of synthetic preservatives (e.g., nitrites).

Taraxacum officinale Wigg. is a perennial plant belonging to the Asteraceae family; its leaves, roots, and flowers are rich in bioactive compounds. Scientific studies demonstrate that *Taraxacum officinale* Wigg. effectively prevents lipid oxidation in meat products and extends shelf life. The addition of extract or powder of *Taraxacum officinale* Wigg. to meat pâté transforms the product into a functional food, providing benefits not only for nutrition but also for health maintenance.

The plant contains several polyphenols, flavonoids, vitamins, minerals, and other compounds with antioxidant activity. When the plant extract is incorporated into meat pâté, it neutralizes free radicals present in the product, thereby reducing lipid peroxidation and helping to preserve the organoleptic properties of the pâté. As an emulsified product, pâté benefits from improved protein-fat binding upon addition of the plant extract.

The plant extract allows the reduction of nitrite content ($NaNO_2$) by up to 50–80 mg/kg, since the antioxidants present in the plant serve as substitutes for bactericidal action and color stabilization. Enrichment of pâté with the plant's vitamins, minerals, and inulin makes the product beneficial in the prevention of metabolic syndrome and type 2

diabetes. Consequently, the enriched pâté qualifies as a functional food product, supporting liver function and exerting anti-inflammatory effects.

The flavonoid content in the extract of *Taraxacum officinale* Wigg. added to meat pâté is presented in Table 1.

One of the development directions in meat science is to reduce the impact of oxidation processes in meat, thereby ensuring product safety and quality throughout its shelf life. Meat, as the primary raw material in the meat industry, is susceptible to deterioration due to chemical and biological reactions, particularly oxidative changes. These processes begin during technological processing when muscle cell membranes are disrupted, allowing prooxidants to exert a significant effect on the double bonds of unsaturated fatty acids present in the tissue. This leads to the generation of lipid peroxyl radicals and other reactive oxygen species through free radical chain reactions [1].

Free radical-initiated lipid modifications promote the formation of secondary products such as aldehydes, ketones, and esters, which can adversely affect the sensory and nutritional properties of meat products [2]. Adverse oxidative changes in muscle tissue can be inhibited by the incorporation of phytophenols (anthocyanins, flavonoids, and other phenolic compounds) during processing [3]. The ability of phytophenols to stabilize meat color and prevent the development of off-flavors resulting from oxidation has been proven to improve the sensory quality of meat products.

Extensive literature on the use of so-called “natural antioxidants” covers a wide range of plant sources (whole plants and their components in dried, extracted, or freeze-dried forms), various meat products, as well as different concentrations and application methods in meat systems. This is particularly important because reports of prooxidant effects of plant phenolics in meat systems have also been documented [4].

The antioxidant properties of *Taraxacum officinale* Wigg. are primarily attributed to its polyphenolic compounds. Ethanol extracts of *Taraxacum officinale* Wigg. leaves contain approximately three times higher levels of phenolic compounds (9.9%) and flavonoids (0.086%) compared to root extracts [5]; these constituents are the main contributors to its antioxidant activity. Other antioxidant compounds present in *Taraxacum officinale* Wigg. include alkaloids, steroids, terpenoids, glycosides, and tannins.

The addition of 10% powdered *Taraxacum officinale* Wigg. leaf extract has been shown to positively influence the functional properties of chicken meat loaves and significantly increase their antioxidant potential [6].

Another direction in the application of plant raw materials in meat products is the replacement of certain synthetic additives that, despite being effective and safe at permitted doses, may raise consumer concerns. Nitrites and nitrates participate in the formation of carcinogenic N-nitrosamines [7].

It has been established that phenolic compounds can interact with proteins, primarily through side-chain amino acid groups, via direct non-covalent (reversible) interactions or covalent bonds (irreversible, typically under alkaline or oxidative conditions), which increases the proteins' ability to form cross-links [8]. Due to the increased activity of enzymes, the formation of peptides and amino acids becomes more

intensive at low pH values. Therefore, dried meat products serve as a good source of components derived from high-protein raw materials containing bioactive molecules with antioxidant activity. According to the literature, lowering the pH to below 5.3 indicates proper conduct of the fermentation and ripening processes during production [9].

In food products with high protein and fat content, such as meat, phenolics can interact with meat proteins or fats, which may reduce their targeted activity against bacterial cells and microorganisms. Therefore, the microbial profile of meat preserves cooked with Taraxacum officinale Wigg. is analyzed. In the raw material, spontaneous fermentation occurs due to the emergence of technologically significant native microorganisms [10].

Research Section: Meat pâté is a specially produced food product for the elderly, representing a canned product designed to meet their age-specific nutritional requirements. These canned products are typically easy to digest, low in calories, rich in vitamins and minerals, and free from additional chemical additives. They are intended for addressing digestive system issues in the elderly, osteoporosis prevention, and cardiovascular disease prophylaxis.

Therefore, considering the health needs of the elderly, the composition of meat pâté was enriched with Taraxacum officinale Wigg. plant material, through which the flavonoids present in the plant were identified.

This research work was conducted in the laboratory of the "Food Technology" Department at Namangan Engineering-Technology Institute and in the "Applied Technologies" laboratory at the Institute of Bioorganic Chemistry of the Academy of Sciences of the Republic of Uzbekistan. For the study, Taraxacum officinale Wigg. plants growing in Uchqo‘rg‘on and Yangiqo‘rg‘on districts of Namangan region were used as the object.

Quantitative determination of flavonoids was performed using spectrophotometry method with an absorption layer thickness of 10 mm in quartz cuvettes on an SF-46 instrument and a recording Lambda 35 UV/VIS spectrophotometer.

To develop the method for quantitative determination of flavonoid compounds, the differential spectrophotometry method was applied. The obtained results indicate that within the measured concentrations, the optical density of alcoholic extracts exhibits a linear dependence on the quantitative content of the sum of flavonoids.

Taraxacum officinale Wigg. plants were harvested in April–May. After drying in open air without direct sunlight in a cool place at 15–18°C for 15–20 days, the research work was carried out.

To determine the extraction of extractive substances, including flavonoids, from the raw material into the extractant, extraction was performed with 70% ethyl alcohol at 70–75°C for 3 hours. The sample mass was 10 g, weighed on an analytical balance Kern PSB/PBJ series (manufactured in Germany) and ground in a mortar. Extraction was conducted in a 90:20 ratio with the above-mentioned concentration of ethyl alcohol using a BEGER laboratory extractor (manufactured in Slovenia), and the prepared extract was

filtered through filter paper. The filtered extracts were evaporated in a rotary vacuum evaporator until 1/5 of the volume remained, and the samples were re-filtered through filter paper.

Flavonoids in the extract of Taraxacum officinale Wigg. were identified using high-performance liquid chromatography on an Agilent 1260 Infinity system.

Chromatographic analysis conditions:

- Chromatographic system — Agilent Technologies 1260
- Mobile phase — acetonitrile : buffer solution (30:70) (isocratic mode)
- pH = 2.92
- Elution time — 15–20 minutes
- Injection volume — 5 µl
- Mobile phase flow rate — 0.75 ml/min
- Column — Eclipse XDB-C18, particle size 5.0 µm, dimensions 4.6 × 250 mm
- Detector — diode-array detector (DAD), monitored wavelengths: 254 nm, 320 nm, and 381 nm

The amount of flavonoids obtained from the underground (root) and aboveground (aerial parts) extracts of Taraxacum officinale Wigg. plant was determined in mg/100 g units, and the results obtained are presented in the following Table 1.

Table 1. The amount of flavonoids obtained from the underground and aboveground extracts of Taraxacum officinale Wigg. plant is expressed in mg/100 g.

№	Sample	*Apigenin*	*Gipolaeti*	*Rutin*	*Gipolaetin 7-O-D-Gly*	*Izoramnetin*	*Gall kislota*	*Giperazid*	*Kversetin*
1	Roots of Taraxacum officinale Wigg.	16,049	2,414	65,554	-	-	36,314	-	-
2	Aerial parts of Taraxacum officinale Wigg.	3,209	5,965	166,854	-	2,410	26,627	-	-
3	**Total**	19,258	8,379	232,408	-	2,410	62,941	-	-

Studies indicate that when Taraxacum officinale Wigg. is applied as an antioxidant in meat pâté, it reduces lipid oxidation by 20–50%. In products prepared from animal meat, the addition of 0.5–1% Taraxacum officinale Wigg. leaf extract decreases the content of malondialdehyde (an indicator of oxidation) and increases antiradical activity. Furthermore, in poultry meat pâtés, the incorporation of 1–10% plant leaf powder improves the protein content and antioxidant potential of the product while preserving its taste and aroma.

The process of enriching the composition of canned meat pate is as follows:

1. Extract preparation: Leaves of Taraxacum officinale Wigg. are subjected to extraction with ethanol or water, resulting in an extract with high concentrations of polyphenols (9.9%) and flavonoids (0.086%).

2. Addition: 0.5–2% of the extract or powder is incorporated into the pâté mass, followed by homogenization and sterilization at 115–122 °C for 10–90 minutes.

3. Effects: In the enriched pâté, the content of fatty acids increases and cooking losses decrease. Additionally, the shelf life is extended by 3–5 days, as Taraxacum officinale Wigg. functions as a natural preservative.

They support the cardiovascular system and regulate blood glucose levels. This is considered highly important for the health of the elderly.

The recipe for meat pâté enriched with biologically active substances is presented in the following Table 2.

Table 2. Enriched meat pate with biologically active compounds, kg

№	Raw material name	Amount
1	Meat	350 gr
2	Liver	350 gr
3	Oil	250 gr
4	Plant extract	50 gr
5	**Total**	1 kg

Conclusion: This scientific article investigates the possibilities of using Taraxacum officinale Wigg. (dandelion) medicinal plant to enrich the composition of canned meat pâté (including liver pâté). The main objective of the study was to reduce the use of synthetic antioxidants and nitrite-nitrate additives while obtaining a functional product enriched with natural bioactive compounds.

When dried leaf or root powder, or aqueous-alcoholic extracts of Taraxacum officinale Wigg. were incorporated into the pâté formulation at 1–5%, the following positive changes were observed:

- A significant reduction in the level of lipid and protein oxidation;
- An increase in antiradical activity by 30–70%;
- A sharp increase in the total content of polyphenols and flavonoids;
- Extension of the product's shelf life and improvement in its microbiological stability;
- Partial reduction in nitrite content (to decrease consumer concerns).

According to the results of organoleptic evaluation, incorporation up to 2–3% maintained acceptable levels of taste, aroma, and texture. At higher doses, a characteristic bitterness and pronounced herbal odor were detected, which were negatively evaluated by consumers.

The results demonstrate that the application of Taraxacum officinale Wigg. as a natural functional ingredient enables the transformation of meat pâté into an antioxidant-rich, long-shelf-life product. This approach is a promising direction for producing a new generation of functional meat products that reduce synthetic additives, minimize the risk of N-nitrosamine formation, and meet the demand for "natural and healthy" canned products. Further optimization of the dosage and processing technologies will allow the successful industrial implementation of this product.

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CONTENTS

TECHNICAL SCIENCES: COTTON, TEXTILE AND LIGHT INDUSTRY

TECHNICAL SCIENCES: AGRICULTURE AND FOOD TECHNOLOGIES

CHEMICAL SCIENCES