

## USING OF MARINADES IN COOKING TECHNOLOGIES OF MAIN-CORE DISHES

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### Abstract

The objective of this study is to investigate technological properties of grilled meat stakes. The thermal losses and cooking duration of beef, pork, mutton and veal stakes until done have been evaluated. The impact of vinegar- and oil-based marinades on this process has been studied. The formula of marinade with kefir and kiwi fruit has been proposed. Kiwi contains food organic acid that leads to softening of meat and kefir is probiotic product that increases the food value of ready meal. It has been founded out that such a marinade has the highest degree of absorption by the product. The caloric value of ready-made dishes has been calculated. Recommendations on further using of marinades in the sphere of restaurant business have been proposed.

**Keywords:** meat dishes, marinade, thermal losses, duration of cooking.

### Introduction

Studies presented in the paper deal with the technology of nutrition namely with making of meat dishes. Last time restaurant enterprises suffered from economical losses on the consumer market of Ukraine. Mainly it was caused by decreasing of consumer ability, reducing the consumer market and absence of the state policy in development and regulation of trade activity. As a result the restaurant enterprises became functioning not in the proper way. Thus, the question of increasing of economical indexes of restaurant business is urgent. One of the possible ways of solving of this problem is decreasing of thermal losses in the technological process of main hot dishes cooking that in case of mass production would have positive effect on the activity of restaurant enterprise.

### Raising the problem

Meat dishes are widely spread and have sustainable demand in restaurants, in particular grilled dishes. Such dishes have shortened cooking time until done (it leads to the fast service of customers) and high nutritional value. During thermal processing the mass of meat decreases and it significantly effects the nutritional value and processing losses. Decreasing of mass takes place by means of water evaporation, and if the more is duration of thermal processing the less is the mass of a product. One uses marinating for such dishes. So it is purposeful to create compositions of marinades that cause decreasing of process losses and saving of nutritional value of meat dishes.

### Literary review

Meat and meat products – are important food products, because consist of all necessary nutrients for the human organism: proteins – 6...21 %, fats – 0.5...37 %, carbohydrates – 0.4 ... 0.8 %, extractive substances – 2.5 .... 3 %, mineral elements – 0.7 ... 1.3 %, enzymes, vitamins – A, PP, B group [1].

Culinary readiness of meat and meat products is characterized by certain structural, mechanical and sensorial indexes – texture, color, taste, smell, succulence. Different ways of thermal cooking processing are used for the meat until done. Choosing of it is caused by the features of morphological structure and chemical composition of meat and meat products, purpose of a ready product and is grounded on the principles of the rational raw materials using [2, 3]. Such means as boiling, frying and baking are the most popular ones.

During thermal processing of meat and meat products such processes take place: softening of products, shape, volume, mass, color, nutritional value, structural and mechanical characteristics changing as well as forming of taste and smell. Character of current changes mostly depends on temperature and duration of heating. Thermal denaturation of muscle proteins starts at 30°...35°C, at 65°C about 90 % denaturation of all muscle proteins takes place [4].

Moreover, water evaporates during frying. Semifinished meat products except for muscle tissue contain also fat. During frying fat is partially absorbed by the product affecting its nutritional value, and also gets melted (during frying of products with significant fat content) [5].

Frying on grill takes place at the temperature of 300° – 350°C using of grill flying pan or open fire. The degree of frying of meat products can vary from rare (with blood), medium to well-done fried meat [6, 7].

Preliminary meat marinating promotes softening of connective tissue and prevents from burning, so marinated grilled meat gets ready even in case of frying up to “with blood” state.

Marinade is a mixture of spices, food additives that give the meat a certain taste (bitter, spicy, sweet) [8]. Salt, food vinegar, onion, herbal oil, spices (garlic, cloves, cinnamon, anise tree and others) are used as traditional ingredients of marinade.

Marinades are classified depending on kinds of product that will be marinated. Marinades for fish, meat, shashlyk, chicken and vegetables are used. Also there is a special group of marinades for the preserving of vegetables or other food products that contain certain components.

The main constituents of marinades are acid, fat, aromatic agent. Acid helps soften meat muscles. Due to oil marinade absorbs meat, impeding juice flowing during frying. Furthermore, oil reveals a full spectrum of aromas – ethers of spices much better dissolve in oil. Fresh greens are also recommended to use in marinades in the ungrounded or largely cutting way. It is because of the fact that chopped greens are difficult to remove from the surface of product and during frying they may burn slightly that will have negative effect on the sensorial indexes of dishes.

Marinades may have different texture – liquid, thick. The most often used kinds of marinades for meat dishes are lemon-, mustard-, wine-, soybean-, kefir-, beer-, mayonnaise-based marinades, onion, vinegar [9, 10, 11, 12, 13, 14]. Also marinades contain honey, mustard, mustard grains, tomato puree or ketchup, fruit juices and extracts (e.g., pomegranate), coca-cola, mineral water.

Salt accelerates deleting of moisture in meat, so it is added not into the marinade but at the final phase of cooking or to the ready dish. When wine is added to the marinade one should follow the rule that white wine suits more the white meat, and red one – the red meat [15].

The degree of sorbing of marinades by meat is 8 ... 20%. So recipes refinement for the meat by means of using certain ingredients gives the possibility to affect the nutritional value of ready dishes.

Sour-milk products have the high degree of digestion. During consumption of sour milk the linked milk acid is released in stomach and intestine represses the action of harmful microorganisms and promotes developing of useful ones. Such a product as kefir contains aminoacids, vitamins, and mineral elements, and is an immune-stimulating functional ingredient [16]. So, marinade that contains kefir helps raise nutritional value of meat dishes.

For providing sour environment of marinade that causes softening of connective tissues of meat usually acid is used – mainly food vinegar. There are different kinds of vinegar – fruit, berry, wine, malt, rice cane and balsamic [17]. However, vinegar and dishes with it are not recommended to people suffering from diseases of gastroenteric origin, gastritis with higher acidity, ulcers, obesity, high blood pressure, diabetes, hepatitis, nephrite, nervous disorders [18]. So, vinegar may be changed for natural acids that also will help soften the meat. For this purpose one uses orange, grapefruit, lemon, lime. These products contain such organic acids as citric, apple. Kiwi is the fruit that contains vitamin C, folic acid, valuable mineral and vitamin composition, organic acids and is regularly presented on the domestic food market. In authors' opinion, using of kiwi in marinades for meat dishes is perspective from the viewpoint of technological effect and nutritional value.

Thus, the authors propose to create the recipe of marinades for the meat dishes using kiwi as a source of food acids and sour-milk products that have valuable chemical composition and positive effect on the human organism. Among other tasks of the paper there were also: to characterize the effect of marinades on the technological process of meat dishes cooking; to study the influence of marinades based on oil, vinegar, sour-milk products and fruits upon the thermal losses; to estimate the nutritional value of meat dishes with marinades; to study the possibility of repeated use of marinades in the technological process.

### Results and discussion

Fried dishes from marinated meat have reduced time of cooking until done, and, as a result, a higher nutritional value. The effect of marinades on the different basis has been investigated in order to obtain the best quality of fried dishes and minimum thermal losses.

Large pieces of ready-to-cook foods – stakes – of different kinds of meat – beef, pork, muton and veal were investigated in the paper (*table 1*).

**Table 1 – Indexes of meat quality**

№	Kind of product	Color	Smell	Taste	Texture
1	Beef (I category) SSU 6030:2008	Red	Peculiar to fresh meat, without an extraneous smell	Corresponds to the requirements of standards, without an extraneous taste	juicy, resilient
2	Pork (meat) SSU 7158:2010	Rosy			
3	Muton (I category) SSU 308:2007	Pale red			
4	Veal (I category) SSU 6030:2008	Pale rosy			

The portioned pieces of meat of 250 g of weight, thickness of 2.5 sm were investigated. BERTOS Electrogrill (Germany) was used for frying with the degree of meat frying– well-done.

After sensorial research meat samples were washed, dried, cleaned, made as portioned stakes, and then – beaten.

At the first stage of research the thermal losses were determined as well as duration of frying until done for the different kinds of meat without preliminary marinating.

Experimental data of thermal losses were obtained as an average value in doing the research in triple repeating (table 2).

The results of thermal losses are within the limits of recommended. The beef meat has the highest value of the thermal losses, which is caused by its texture. The pork and mutton meat have the lowest values of thermal losses. Frying duration was about 15 ... 20 minutes.

**Table 2 – Indexes of the technological process of meat stakes making**

№	Kind of meat	Reference values of thermal losses [16], %	Experimental data of thermal losses, %	Time of cooking until done, minutes
1	Beef	37 – 40	38.9±0,5	20 ±1
2	Pork	32 – 40	31.0±0,2	17±1
3	Mutton	30 – 37	30.8±0,5	20±1
4	Veal	36 – 37	36.0±0,2	15±1

As the literary review has shown, the marinades based on vinegar, oil and sour-milk products are widely used in cooking of fried meat dishes. The objective of the paper was to create the recipe of marinades to provide a high quality of ready dishes, shorten the duration of cooking and provide a high nutritional value.

The oil-based marinade with adding of spices (garlic, pepper, savory and rozmarin) was chosen as a controlling sample. This marinade can be used not only for meat dishes but also for fish, so it was called “Universalnyi”. The ratio of main ingredients of the marinade has been experimentally selected in the “Mafia” restaurant (Kyiv) (Table 3). The technology of preparation of “Universalnyi” marinade suggested implementation of such operations: chili was purged from seed, cut into bars, garlic - into plates. These ingredients were fried during 30 seconds; oil was heated to the temperature of 80 °C, fried garlic and chili were added to it. At the end savory and rozmarin were added going on heating for 3 minutes and then were cooled to the temperature of 40 °C.

Also the recipe of food vinegar-based marinade called “Klasychnyi” was proposed (Table 3). For its preparing the peeled onion was cut into rings, prepared water was added to vinegar and onion, at the end pepper and laurel leaf were added.

The recipe of marinade called “Caloriynyi” was proposed as the marinade for increasing the nutritional value of ready dishes (Table 3). Preparation of this marinade is based on the following: kiwi and onion chopped were added to kefir and infused during 1 hour. Kiwi is a source of fruit acid, that stimulates softening of meat, and kefir enables to provide the high nutritional value of products with acceptable quality.

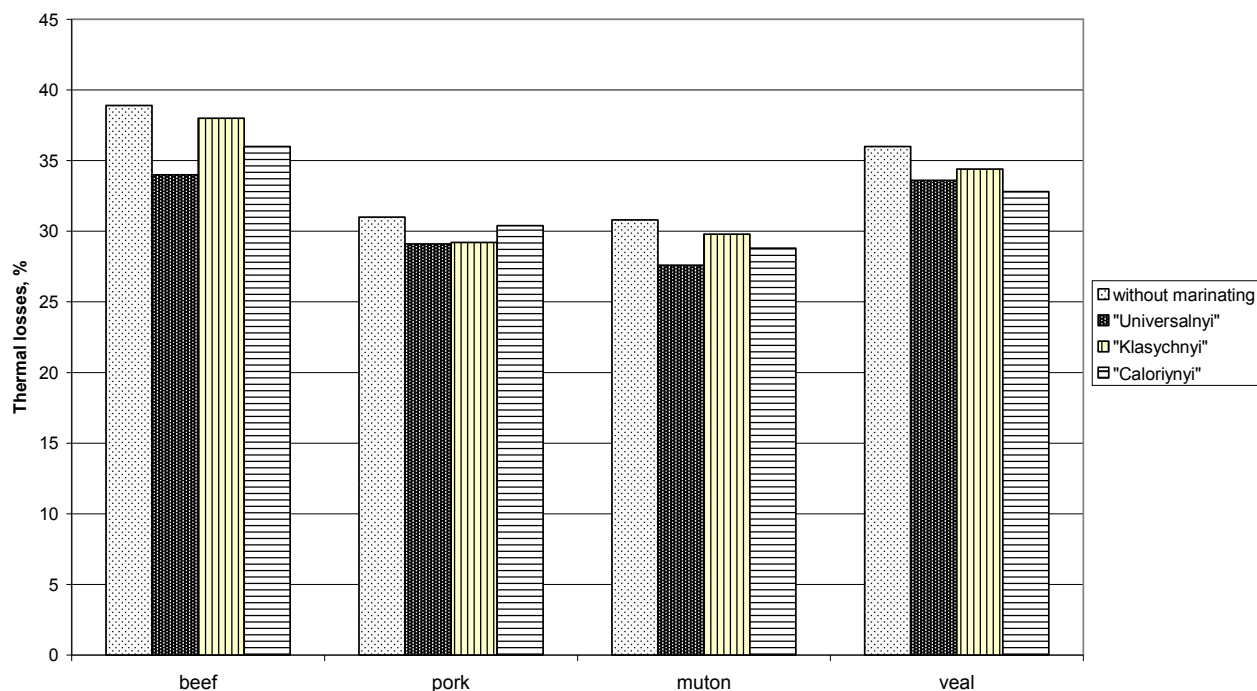
During marinating the mass of meat increased due to diffusion and marinade that remained on the meat. The values of absorption degree are different for the studied marinades because marinades with a liquid basis are less absorbed by meat than marinades with a thick basis. A different degree of marinades absorbing by meat has been found out experimentally – for «Universalnyi» marinade - 10 %, «Klasychnyi» - 5%, «Caloriynyi» – 15%.

**Table 3 – Recipes of marinades**

№	Raw material	«Universalnyi»	«Klasychnyi»	«Caloriynyi»
		Weight of raw materials, g, per 1 portion 250 g, net weight		
1	Sunflower oil	185	-	-
2	Garlic	23	-	-
3	Chili	14	-	-
4	Savory	9.3	-	-
5	Rozmarin	9.3	-	-
6	Oil for frying	9.4	-	-
7	Vinegar 3%	-	44	-
8	Onion	-	72	28
9	Pepper in peas	-	1,9	-
10	Laurel leaf	-	0.02	-
11	Prepared water	-	132	-
12	Kefir 3.2%	-	-	170
13	Kiwi	-	-	52

The samples of meat were marinated during 6 hours – this time was considered as optimal according to the preliminary experiments. After marinating extra marinade was taken away, a steak was weighed and fried on the heated

grill until well-done. After frying the sample was cooled up to the room temperature, weighed, then values of thermal losses were calculated (Fig. 1).



**Fig. 1. Thermal losses of fried meat after marinating**

It was founded out that preliminary marinating helps decrease thermal losses in frying of all kinds of meat under investigation by 1.9 ... 4.9 %. Oil-based marinade ("Universalnyi") saves the mass of meat most of all; "Caloriynyi" marinade makes similar effect for beef, mutton and veal – thermal losses reduce by 0.6 – 3.2 %. The effect of the oil- and vinegar-based marinades for pork is identical – the loss of mass is within the same limits. On the whole, the effect of marinades for pork is expressed in the lowest way – thermal losses reduce by 0.6 – 1.0 %. The best marinade for beef is "Universalnyi", "Caloriynyi" marinade is characterized by the lowest thermal losses for the veal meat. The mutton meat loses the similar mass amount both for «Universalnyi» and «Caloriynyi» marinades.

Table 4 shows the decreasing of duration of meat frying after marinating. In most cases such effect takes place for beef and mutton meat. "Klasychnyi" and "Caloriynyi" marinades provide the shortest cooking time due to soften meat texture.

Thus, "Universalnyi" and "Caloriynyi" marinades have resulted in similar quality indicators of meat steaks, technological indexes of production. But, the latter does not contain vinegar. Kiwi, a natural food product is used as a source of acid, which is positive. Thus, "Caloriynyi" marinade is recommended for marinating of different kinds of meat, and the best values are obtained for the veal meat.

**Table 4 – Duration of marinated meat frying**

№	Kind of meat	Duration of frying, minutes			
		Without marinating	with «Universalnyi» marinade	with «Klasychnyi» marinade	with «Caloriynyi» marinade
1	Beef	20±1	18±1	17±1	17±1
2	Pork	17±1	16±0.5	15±1	15±0.5
3	Mutton	20±2	18±1	18±1	17±1
4	Veal	15±1	14±1	13±1	13±0.2

Caloric value for marinades, meat and marinated meat was calculated using data of chemical composition of products [1] and taking into account the degree of marinade absorbing mentioned above.

**Table 5 – Caloric value of meat**

Kind of meat	Caloric value of meat, kcal.			
	Without marinating	Oil-based «Universalnyi» marinade	Vinegar-based «Klasychnyi» marinade	Kefir and kiwi-based «Caloriynyi» marinade
Beef	218	223	220	232
Pork	357	362	361	371
Mutton	209	214	213	223
Veal	97	102	101	111

As a result it has been found out that «Universalnyi» and «Klasychnyi» marinades provide the similar caloric content of meat dishes, and «Caloriynyi» causes a growth of caloric value of dishes by 4 ... 14 % thus enriching the dishes by valuable macro- and micronutrients.

In hot workshops of restaurants a considerable part of marinade remains, because meat absorbs only a part of it (5...15 % from the total amount of marinade as it was mentioned above). The rest of marinade contains some remains of production, repeatedly marinades are not used on purpose. The authors propose further using of oil-based and vinegar-based marinades, because in repeated using these kinds of marinades save quality and nutritional value. «Caloriynyi» marinade contains sour-milk products that have limited time of using due to a danger of microbial damage. So repeated using of this marinade may cause food poisonings. Thus «Caloriynyi» marinade is eliminated for further using.

After using of oil-based marinade it is filtered, oil with aroma of garlic and pepper passes to the filtrate. So, filtrate may be used for frying of vegetables, meat and fish. Oil aroma has a positive effect on taste properties of food. But if dishes with aroma of herbs, garlic and pepper are eliminated on the menu, oil can be used in regular food of personnel. Also filtrate can be used for frying in a friture depending on recipes of dishes and for cold dishes and snakes dressing, souce producing.

Vinegar-based marinade is also proposed to be filtered, while separating vinegar from onion. Marinated onion may be used in cooking of cold dishes and snakes, souces, personnel nutrition. Vinegar may be used for making salad vinegar-based dressings.

#### Approbation of research results

The results have been tested in “Mafia” restaurant (Kyiv). The technological documentation for the meat steaks with experimental marinades has been developed and confirmed. According to calculation cards it has been found out that vinegar-based marinade called «Klasychnyi» has the lowest cost, “Caloriynyi” marinade takes the intermediate place, and «Universalnyi» marinade has the highest cost.

#### Conclusion

The fruit, in particular kiwi, was proposed to use in marinades as a source of fruit acids for softening the meat texture. It helps shorten the cooking time and also increases consumer properties of food. Thus it is possible to give up vinegar that is widely used and is not a useful product for the human health. Also kefir as a component of marinade with kiwi was proposed for increasing a nutritional value of food and giving it probiotic properties.

Thermal losses in cooking of fried meat dishes after marinating of pork, beef, mutton and veal have been studied. Shortening the duration of cooking time by 0.6 ... 4.8 % for the marinated meat dishes has been found out. More often it is typical in the case of frying of beef and mutton meat. «Klasychnyi» and “Caloriynyi” marinades facilitate the shortest meat cooking duration due to providing of soften meat texture. “Caloriynyi” marinade shows the most positive effect to the veal meat.

The caloric value of marinades and meat dishes with them have been calculated. It has been found out that “Caloriynyi” marinade increases the caloric value of dishes by 4 ... 14 %.

The technological recommendations for the repeated using of marinades have been proposed.

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Робота присвячена дослідженню технологічних показників приготування на грилі других м'ясних страв. Вивчали теплові втрати та тривалість приготування до готовності стейків з м'яса яловичини, свинини, баранини і телятини. Використовували попереднє маринування стейків маринадами на основі олії, оцту. Запропоновано рецептуру маринаду з ківі та кефіром – ківі містить харчові органічні кислоти, що пом'якшують м'ясо, кефір є пробіотиком, що підвищує харчову цінність готової страви. Встановлено, що такий маринад має найвищу ступінь поглинання продуктом. В результаті попереднього маринування теплові втрати при приготуванні м'ясних страв скорочуються на 1,9 – 4,9 %, тривалість приготування - на 0,6 – 4,8 %. У більшій мірі такий вплив проявляється у разі смаження м'яса яловичини і баранини. Найвищий технологічний ефект від застосування маринаду з ківі і кефіром характерний для м'яса телятини.

Розширена анотація українською мовою

## **USING OF MARINADES IN COOKING TECHNOLOGIES OF MAIN-COURSE DISHES**

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The objective of this study is to investigate technological properties of grilled meat steakes. The thermal losses and cooking duration of beef, pork, mutton, and veal steakes until done were evaluated. The vinegar- and oil-based marinades were used before cooking. The formula of marinade with kefir and kiwi fruit was proposed. Kiwi contains food organic acid that leads to softening of meat and kefir is a probiotic product that increases the nutritional value of ready meals. It has been found out that such a marinade has the highest degree of absorption by the product. After previous marinating the thermal losses decrease by 1.9 – 4.9 % and duration of cooking – by 0.6 – 4.8 %. The most significant effect is peculiar to cooking of veal and mutton meat. The most positive technological effect after using of kefir and kiwi-based marinade for the veal steakes has been observed.