



# IQTISODIYOT & TARAQQIYOT

*Ijtimoiy, iqtisodiy, texnologik, ilmiy, ommabop jurnal*

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# MUNDARIJA

|   |    |
|---|----|
| YASHIL ENERGIYA SEKTORIDA VENCHUR INVESTITSIYALARINING RIVOJLANISHI:<br>GLOBAL TENDENSIYALAR VA O'ZBEKISTON IMKONIYATLARI .....                 | 12 |
| <b>Qarajanova Gulnoza Tolliyevna</b>  |    |
| MILLIY KOMPANIYALARNI BAYNALMILALLASHUV BOSQICHLARI VA<br>XALQARO KORPORATIV BIRLASHUVLAR<br>(M&A) STRATEGIYASINI TAKOMILLASHTIRISH.....        | 19 |
| <b>Shokirov Shoxruxmirzo Baxtiyorjon o'g'li</b>   |    |
| QISHLOQ XO'JALIGINI IQLIM VA EKOLOGIK O'ZGARISHLARGA MOSLASHTIRISHDA<br>SMART TEXNOLOGIYALARNI JORIY ETISH METODOLOGIYASINI RIVOJLANTIRISH..... | 23 |
| <b>Mirzataev Salamat Muratbaevich</b>   |    |
| QISHLOQ XO'JALIGIDA MEVACHILIK KLASSTERLARINI TASHKIL ETISHNING<br>ISHLAB CHIQRISH VA RENTABELLIK KO'RSATKICHLARIGA TA'SIRI .....               | 28 |
| <b>Tureev Azizbek Abatovich</b>   |    |
| QORAQALPOG'ISTON RESPUBLIKASIDA QURILISH XIZMATLARINI SUN'IY INTELLEKT<br>ASOSIDA RIVOJLANTIRISHNING STRATEGIK MODELII.....                     | 32 |
| <b>Qidirniyazov Ajiniyaz Sherniyazovich</b>   |    |
| TOG'-KON SANOATI KORXONALARIDA RESURS TEJAMKOR TEXNOLOGIYALAR ASOSIDA<br>IQTISODIY SAMARADORLIKNI OSHIRISHNING NAZARIY-USLUBIY ASOSLARI.....    | 37 |
| <b>Kurbanova Mehriniso Nematjanovna</b>   |    |
| <b>Sharipov Kongratbay Avezimbetovich</b>   |    |
| THE DEVELOPMENT OF THE NATIONAL INSURANCE MARKET AND THE LEVEL OF<br>INCLUSIVENESS.....   | 43 |
| <b>Ravshanova Mohinur O'rolovna</b>   |    |
| O'ZBEKISTON TEMIR YO'LLARI AJ KORXONALARIDA IQTISODIY<br>SAMARADORLIKNI OSHIRISHNING ZAMONAVIY YONDASHUVLARI.....                               | 51 |
| <b>Kurbonova Ma'mura Abdukarim qizi</b>   |    |
| TO'QIMACHILIK SANOATI KORXONALARINING MOLIYAVIY<br>BARQARORLIGINI TA'MINLASH MEXANIZMLARI.....  | 55 |
| <b>Qaraev Anvar Botirovich</b>  |    |
| THE IMPACT OF LOYALTY PROGRAMS ON CUSTOMER RETENTION IN ONLINE<br>COSMETICS: A MIXED-METHODS STUDY .....  | 61 |
| <b>Toirova Mubina</b>   |    |
| IQLIM O'ZGARISHI VA "YASHIL" TRANSFORMATSIYANING JAHON MOLIYA<br>BOZORLARIGA TA'SIRI.....   | 66 |
| <b>Qo'chqorova Muxlisaxon Ulug'bek qizi</b>   |    |
| KICHIK BIZNES RIVOJLANISHIDA RAQAMLI PLATFORMALAR - ELEKTRON TIJORAT<br>SAYTLARI, MARKETPLEYSLAR VA MOBIL ILOVALARNING O'RNI.....               | 73 |
| <b>Rizayeva Nilufar Oblakulovna</b>   |    |
| SUN'IY INTELLEKT TEXNOLOGIYALARINING BIZNES JARAYONLARINI<br>OPTIMALLASHTIRISHDAGI IQTISODIY SAMARADORLIGI .....                                | 79 |
| <b>Abdulla Mavlonov</b>   |    |
| QISHLOQ XO'JALIGIDA SABZAVOTCHILIK MAHSULOTLARI LOGISTIKASINI<br>RAQAMLASHTIRISH ORQALI BOZOR INFRATUZILMASI SAMARADORLIGINI<br>OSHIRISH.....   | 82 |
| <b>Komekova Gulzira Sharbaevna</b>  |    |



|   |     |
|---|-----|
| МЕТОДОЛОГИЧЕСКИЕ ПОДХОДЫ К АГРЕГИРОВАНИЮ РАЗРОЗНЕННЫХ ДАННЫХ В ЭКОНОМЕТРИЧЕСКИХ ИССЛЕДОВАНИЯХ .....   | 87  |
| <b>Бекматов Акмал Курбонмахматович</b>  |     |
| SUG'URTA TASHKIOTLARIDA MHXSGA O'TISHNING HOZIRGI HOLATI VA MUAMMOLARI .....  | 93  |
| <b>Azamatova G. I.</b>  |     |
| O'ZBEKISTON SOG'LIQNI SAQLASH TIZIMINI RAQAMLASHTIRISHGA YO'NALTIRILGAN INVESTITSIYALARNING XARAJAT-FOYDA TAHLILI .....   | 98  |
| <b>Omonov Olim Murodullayevich</b>  |     |
| RAQAMLI IQTISODIYOT SHAROITIDA INNOVATSION TA'LIM TEXNOLOGIYALARINI JORIY ETISHNING IQTISODIY SAMARADORLIGI .....   | 104 |
| <b>Isxakova Sarvar Ayubovna</b>   |     |
| <b>Amriyeva Shaxzoda Shuxratovna</b>  |     |
| ПРИМЕНЕНИЕ МЕТОДОВ МАШИННОГО ОБУЧЕНИЯ В КРЕДИТНОМ СКОРИНГЕ РОЗНИЧНЫХ ЗАЁМЩИКОВ: ОПЫТ АКБ «КАПИТАЛБАНК» (РЕСПУБЛИКА УЗБЕКИСТАН) .....  | 109 |
| <b>Жанайдарова Камола Абаевна</b>   |     |
| INVESTITSION LOYIHALARNI MOLIYALASHTIRISHDA IPO VA KORPORATIV OBLIGATSIYALAR SAMARADORLIGI .....  | 115 |
| <b>G'afurov Sherzod Abdvaxob o'g'li</b>   |     |
| O'ZBEKISTON TURIZM BOZORINI RIVOJLANTIRISHDA MARKETING TADQIQOTLARNING AHAMIYATI .....  | 120 |
| <b>Usmanova Zumrad Islamovna</b>  |     |
| O'ZBEKISTONDA YASHIL VODOROD IQTISODIYOTINI RIVOJLANTIRISHNING BIZNES VA INVESTITSION MEKANIZMLARI .....  | 123 |
| <b>Nuraliyeva Komila Sanaqulovna</b>  |     |
| XUFYONA IQTISODIYOTNI QISQARTIRISHDA XALQARO TAJRIBALAR TAHLILI: SOLIQ ISLOHOTLARI VA RAQAMLASHTIRISHNING AHAMIYATI .....   | 130 |
| <b>Utkirova Jasmina Jasur qizi</b>  |     |
| XORIJIY DAVLATLAR AMALIYOTIDA XUSUSIY INVESTITSIYALAR VA AHOLI DAROMADLARI O'RTASIDAGI MUTANOSIBLIKNI TARTIBGA SOLISH YO'NALISHLARI .....   | 135 |
| <b>Salimova Zaxro Sobirjon qizi</b>   |     |
| QAYTA TIKLANUVCHI ENERGIYA MANBALARINI RIVOJLANTIRISHNING IQTISODIY TAHLILI VA BASHORATI .....  | 141 |
| <b>Xakimov D.R.</b>   |     |
| ВЛИЯНИЕ ТЕХНОЛОГИЧЕСКОГО ПРОГРЕССА НА ЗАНЯТОСТЬ: ОПТИМИЗАЦИЯ И ТРАНСФОРМАЦИЯ РАБОЧИХ МЕСТ .....   | 151 |
| <b>Эркинбаева Камила Жавлонбековна</b>  |     |
| TIJORAT BANKLARI MOLIYAVIY RESURSLARINI BOSHQARISHNI TAKOMILLASHTIRISH .....  | 156 |
| <b>Tangirkulov Bekzod Boxadirovich</b>  |     |
| HUDUDLARDA TURISTLARGA UMUMIY OVQATLANISH XIZMATLARINI KO'RSATISHNING SAMARALI RIVOJLANISH USULLARINI TAKOMILLASHTIRISH: RFEI INDEKSI, KLASSTER MODEL I VA "TASTE UZBEKISTAN" RAQAMLI EKOTIZIMI ..... | 162 |
| <b>Maxmadiyeva Charos Xayrullayevna</b>   |     |
| SAVDODA MARKETING TADQIQOTLARINING ZAMONAVIY TENDENSIYALARI .....   | 171 |
| <b>Jalalova Dildora Jamolovna</b>   |     |
| КЛИМАТИЧЕСКОЕ ФИНАНСИРОВАНИЕ И ЧЕЛОВЕЧЕСКИЙ КАПИТАЛ В КОНТЕКСТЕ ДОСТИЖЕНИЯ ЦЕЛЕЙ УСТОЙЧИВОГО РАЗВИТИЯ .....   | 174 |
| <b>Лана Цхай</b>  |     |
| UZOQ MUDDATLI AKTIVLARNI MOLIYAVIY HISOBOTDA AKS ETTIRISHNI MASALALARI .....  | 181 |
| <b>G'oziyeva Moxira Rustam qizi</b>   |     |



|  |     |
|--|-----|
| TA'LIM MUASSASALARIDA LIDERLIK SAMARADORLIGINING NAZARIY-METODOLOGIK ASOSLARI .....  | 189 |
| <b>Yuldashova Yoqutoy</b>  |     |
| KICHIK VA O'RTA BIZNESNI RAQAMLI KREDITLASHNING O'ZBEKISTON<br>IQTISODIYOTIGA TA'SIRI .....  | 193 |
| <b>Karimova Aziza Maxomadrizoyevna</b><br><b>Abduraxmonov Faridun Firo'z o'g'li</b>  |     |
| SANOAT TARMOQLARIDA QAYTA TIKLANUVCHI ENERGIYA KONSEPSIYASINING<br>IQTISODIY VA INSTITUTSIONAL MAZMUNI .....   | 199 |
| <b>Mamarasulova Iroda Zafarjon qizi</b>  |     |
| ESG-ТРАНСФОРМАЦИЯ ПРЕДПРИЯТИЙ ПО ПРОИЗВОДСТВУ ПОЛИМЕРНОЙ УПАКОВКИ:<br>ТЕОРИЯ, ОТРАСЛЕВАЯ СПЕЦИФИКА И МИРОВЫЕ ПРАКТИКИ.....                               | 204 |
| <b>Ташпулатов Дильмурад Рустамович</b>   |     |
| ENHANCING GREEN ACCOUNTING IN UZBEKISTAN: COMPARATIVE LESSONS FROM<br>DEVELOPED ECONOMIES FOR SUSTAINABLE DEVELOPMENT .....                              | 210 |
| <b>Xolmurodova Durdona Otamurod qizi</b>   |     |
| ЭКОНОМИЧЕСКИЕ, СОЦИАЛЬНЫЕ И ЭКОЛОГИЧЕСКИЕ АСПЕКТЫ РАЗВИТИЯ<br>КУЛЬТУРНОГО ТУРИЗМА В УЗБЕКИСТАНЕ .....  | 218 |
| <b>Саттарова Зухра Илхомовна</b>   |     |
| KICHIK BIZNES RIVOJLANISHINING HUDUDIY INVESTITSIYA FAOLLIGIGA TA'SIRI .....   | 224 |
| <b>Toirjonov Sardorbek Dilshodjon o'g'li</b>   |     |
| HUDUDIY IQTISODIY RIVOJLANISHDA KICHIK BIZNESNING BANDLIKNI<br>TA'MINLASHDAGI AHAMIYATI .....  | 229 |
| <b>Mamadaliyev Doniyorbek Shuhratbek o'g'li</b>  |     |
| TOSHKENTDA KICHIK BIZNES KORXONALARIDA RAQAMLI<br>TEKNOLOGIYALARDAN FOYDALANISH SAMARADORLIGI: LOGIT VA PROBIT<br>MODELLARI ASOSIDA EMPIRIK TAHLIL ..... | 235 |
| <b>Hasan Ibragimov</b><br><b>Mannonov Shahzod</b><br><b>Toshmurod Qulmanov</b>   |     |
| MOSLASHUVCHAN MENEJMENT VA UNING SIFAT BOSHQARUVIDAGI O'RNI .....  | 242 |
| <b>Ibroximova Zuhra Baxtiyor qizi</b>  |     |
| IJTIMOIIY SOHANI BARQAROR RIVOJLANTIRISHNING MINTAQAVIY XUSUSIYATLARI.....   | 247 |
| <b>Ro'zmetov Kamol Ibodullayevich</b><br><b>Ibragimov Qayumbek Ikromovich</b>  |     |
| TIJORAT BANKLARI AKTIVLARI SAMARADORLIGINI OSHIRISHNING ILG'OR<br>XORIY TAJRIBALARI.....   | 254 |
| <b>Muminov Bekzod Polvonovich</b>  |     |
| KORPORATIV AXBOROT TIZIMLARINI RAQAMLASHTIRISH KONSEPSIYASINING<br>NAZARIY EVOLYUTSIYASI VA ZAMONAVIY YONDASHUVLAR TASNIFI.....                          | 263 |
| <b>Kuchkarov Ulug'bek Tahirovich</b>   |     |
| O'ZBEKISTON RESPUBLIKASI MINTAQALARIDA EKSPORT<br>FAOLIYATINI RIVOJLANTIRISHNING NAZARIY-METODOLOGIK ASOSLARINI<br>TAKOMILLASHTIRISH.....                | 268 |
| <b>Abdulatifova Moxinur Alisher qizi</b>   |     |
| FIZIKA FANINI SUN'IY INTELLEKT INTEGRATSIYASI ASOSIDA SAMARALI<br>O'QITISHNING INNOVATSION YONDASHUVLARI.....  | 275 |
| <b>Razzoqov I.D.</b>   |     |
| RAQAMLI MEHNAT BOZORLARI VA IQTISODIY BARQARORLIK: O'ZBEKISTON VA<br>QOZOG'ISTON MISOLIDA QIYOSIY TAHLIL .....   | 281 |
| <b>Safarova Gulruh Akmal qizi</b>  |     |
| СОЦИАЛЬНО-ЭКОНОМИЧЕСКАЯ СУЩНОСТЬ КАТЕГОРИИ ЭФФЕКТИВНОСТИ И НАУЧНЫЙ   |     |



|  |     |
|--|-----|
| ПОДХОД К ЕЁ ОПРЕДЕЛЕНИЮ.....   | 287 |
| <b>Зайналов Ж. Р.</b>  |     |
| О'ZBEKISTONDA KICHIK BIZNES SUBYEKTLARINING MAMLAKAT<br>IQTISODIYOTIDAGI O'RNI.....  | 293 |
| <b>Xolmatova Mumtozbeqim Alisherxon qizi</b>   |     |
| TURISTIK BOZOR KONYUNKTURASINI O'RGANISHNING NAZARIY VA AMALIY<br>JIHATLARI.....     | 298 |
| <b>Usmanova Zumrad Islamovna</b>   |     |
| PREPARATION OF NUT JAM USING MULBERRY SYRUP BASED<br>ON ITS CONSUMER PROPERTIES..... | 302 |
| <b>Pardaev Gayrat Yakhshibaevich</b>   |     |



# PREPARATION OF NUT JAM USING MULBERRY SYRUP BASED ON ITS CONSUMER PROPERTIES

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**Abstract:** This paper explores the potential of using mulberry syrup, made from mulberry fruits that ripen almost simultaneously with walnuts in the milky stage, as an alternative to sugar in the preparation of walnut jam. A comparative analysis of the consumer properties, including organoleptic, physicochemical, and other characteristics, was conducted for products with added sugar and those with mulberry syrup. The results showed that mulberry syrup not only improves the taste and aroma of the product but also enhances its functional properties due to its content of biologically active substances. We also consider the organoleptic characteristics of this jam, which are directly related to consumer properties. The antioxidant properties of this jam were also characterized. Furthermore, this article reflects the government's interest in the development of walnuts, in connection with the creation of a walnut growing association, as the nut is an export-oriented commodity in some countries and is in high demand worldwide. This article also discusses the historical significance of this product in the life of our region.

**Keywords:** Walnut; Consumer properties; Mulberry syrup; Jam; Sugar; Organoleptic evaluation.

**Annotatsiya:** Ushbu maqola yong'och murabboni tayyorlashda shakarga alternativa sifatida sutli bosqichdagi yong'och bilan deyarli bir vaqtning o'zida pishadigan tut mevalaridan tayyorlangan tut siropidan foydalanish imkoniyatlarini o'rganadi. Shakar qo'shilgan va tut siropi qo'shilgan mahsulotlar uchun iste'mol xususiyatlarining, jumladan, organoleptik, fizik-kimyoviy va boshqa xususiyatlarning qiyosiy tahlili o'tkazildi. Natijalar shuni ko'rsatdiki, tut siropi nafaqat mahsulotning ta'mi va xushbo'yiligini yaxshilaydi, balki biologik faol moddalar miqdori tufayli uning funksional xususiyatlarini ham oshiradi. Shuningdek, ushbu murabboning iste'mol xususiyatlari bilan bevosita bog'liq bo'lgan organoleptik xususiyatlari ham ko'rib chiqiladi. Ushbu murabboning antioksidant xususiyatlari ham tavsiflangan. Bundan tashqari, ushbu maqola yong'och yetishtiruvchilar assotsiatsiyasini yaratish munosabati bilan hukumatning yong'ochchilikni rivojlantirishga qiziqishini aks ettiradi, chunki yong'och ayrim mamlakatlarda eksportga yo'naltirilgan tovar hisoblanadi va butun dunyo bo'ylab yuqori talabga ega. Ushbu maqolada, shuningdek, mazkur mahsulotning mintaqamiz hayotidagi tarixiy ahamiyati muhokama qilinadi.

**Kalit so'zlar:** yong'och, iste'mol xususiyatlari, tut siropi, murabbo, shakar, organoleptik baholash.

**Аннотация:** В данной статье исследуется потенциал использования сиропа из шелковицы, приготовленного из плодов шелковицы, созревающих почти одновременно с грецкими орехами в молочной стадии, в качестве альтернативы сахару при приготовлении орехового джема. Проведен сравнительный анализ потребительских свойств, включая органолептические, физико-химические и другие характеристики, продуктов с добавлением сахара и продуктов с сиропом из шелковицы. Результаты показали, что сироп из шелковицы не только улучшает вкус и аромат продукта, но и повышает его функциональные свойства благодаря содержанию биологически активных веществ. Также рассмотрены органолептические характеристики этого джема, которые напрямую связаны с потребительскими свойствами. Были также охарактеризованы антиоксидантные свойства этого джема. Кроме того, в статье отражен интерес правительства к развитию выращивания грецких орехов в связи с созданием ассоциации грецких ореховодов, поскольку этот орех является экспортно-ориентированным товаром в некоторых странах и пользуется высоким спросом во всем мире. В статье также обсуждается историческое значение этого продукта в жизни нашего региона.

**Ключевые слова:** Грецкий орех; Свойства для потребителей; Шелковичный сироп; Джем; Сахар; Органолептическая оценка.



## INTRODUCTION

Uzbekistan is renowned for its diverse agricultural crops, among which nuts hold a special place. The history of nut cultivation in Uzbekistan dates back to ancient times. Archaeological finds indicate that the ancient civilizations that inhabited this land already valued these crops. Currently, special attention is being paid to the development of nut production, particularly walnuts. This is evidenced by the Decree of the President of the Republic of Uzbekistan dated June 1, 2017, "On the Establishment and Organization of the Activities of the Association of Walnut Producers and Exporters" (President's Decree No. PP-3025, 2017). This Decree provides for the efficient use of rainfed lands and an increase in walnut production to make it competitive in both domestic and foreign markets. Through the creation of modern plantations and the active implementation of scientifically based methods, intensive technologies for growing and processing walnut fruits based on attracting foreign investment, researchers have recently carried out significant work on the study of genetic resources, biochemical properties, as well as selection and propagation of walnuts (Vahdati et al., 2019).

Walnuts (*Juglans regia* L.) are valued for their nutritional and health benefits, especially at the milk-ripe stage. Sugar is traditionally used to make jam, but with the growing interest in healthy eating, the search for natural syrups as sweeteners is relevant (Akpinar-Bayazit, 2010). Mulberry syrup, obtained from mulberry fruits, has high nutritional value and can serve as a worthy alternative to sugar (Kang et al., 2016). This sweetener is rich in B vitamins, iron, potassium, and amino acids (Gursoy & Sarikurcu, 2019).

## REVIEW OF LITERATURE ON THE SUBJECT

Existing research highlights the nutritional and technological potential of both walnuts and mulberry-based products. Akpinar-Bayazit demonstrated the high nutritional value of black mulberry (*Morus nigra* L.) in her research, highlighting its content of bioactive compounds. Y. Kang further confirmed the antioxidant and anti-inflammatory activity of green walnut shell extracts in their article, substantiating the feasibility of using walnuts in functional foods. N. Gursoy and S. Sarikürkcu presented a comprehensive review of *Morus* species, demonstrating that mulberry syrup is rich in B vitamins, iron, potassium, and essential amino acids, making it a functional ingredient rather than just a sweetener.

From a technological perspective, replacing refined sugar with natural syrups is a growing trend in food science. Livesey G. discussed the health potential of sugar substitutes, particularly their low-glycemic properties, which is especially important for diabetics and health-conscious consumers. Molyneux P. standardized the DPPH method for assessing antioxidant activity, a method widely used to compare the free radical scavenging capacity of fruit products. In the context of Uzbekistan, the strategic importance of walnut cultivation was officially recognized by Presidential Decree No. PP-3025 of Mirziyoyev Sh.M., which encourages the implementation of modern, intensive technologies and scientific methods. Furthermore, Vahdati K., Arab M.M., Sarikhani S., Sadat Hosseini M., Leslie C.A., and Brown P.J. reviewed global advances in walnut breeding strategies, including genetic resource management and breeding methods, which are directly related to improving the quality of raw materials for processing. However, despite the recognized benefits of mulberry syrup and the nutritional value of walnuts, no systematic studies have previously been conducted on the feasibility of replacing sugar syrup with mulberry syrup in the production of jam from unripe walnuts. Specifically, the impact of such a substitution on organoleptic properties, pH, antioxidant activity, and microbiological stability remains unexplored. All of these qualities influence the consumer properties of jams made from unripe walnuts, which in turn enhances their consumer appeal. This gap in the literature justifies the present study.

## RESEARCH METHODOLOGY

Our research methods included assessing the quality of the control and experimental samples and evaluating them organoleptically based on taste, aroma, color, and texture. To enhance the reliability of the organoleptic method, we conducted tasting evaluations on a 5-point scale. Eleven tasters participated in the tasting. The tasters processed the results statistically, calculating the arithmetic mean of each indicator on a 5-point scale. We also determined dry matter content using refractometry, pH using a digital pH meter, and total antioxidant activity using the DRRN method.

## ANALYSIS AND RESULTS

The main objective of this study was to examine the possibility of replacing sugar syrup with a natural product, mulberry syrup, when making jam from milk-ripe walnuts. Mulberry syrup, due to its significant vitamin and micronutrient content, enriches the finished product with these valuable biologically active substances.

On the other hand, mulberry syrup contains easily digestible sugars—glucose and fructose—which are also present in this jam and can be recommended for diabetics.

We prepared two batches of jam:

- 1) Control—based on 1 kg of milk-ripe walnuts with the addition of 0.5 kg of a 60% sugar syrup solution;
- 2) Experimental—based on 1 kg of milk-ripe walnuts with the sugar syrup replaced by 0.5 kg of mulberry syrup with a soluble solids concentration of 12%. As is well known, walnuts at the milky stage have a bitter taste due to their high tannins and organic acids. To remove this bitterness, the nuts were thinly peeled, pierced, and soaked in water for 5 days, changing the water daily. To completely remove the bitterness, they were then soaked again in a 5% lime solution. Following this, both samples were boiled in three 30-minute increments over medium heat, with 25-30 minute rests in between, following the recipe described above. The control samples were boiled to a soluble solids content of 62%, and the test samples to a soluble solids content of 58%. The resulting control and test jam samples were then subjected to quality testing for organoleptic and physicochemical properties.

The results of the comparative 5-point quality assessment of the control and test jam samples are presented in Table 1 (Table 1).

Table 1  
Results of organoleptic evaluation of jam quality<sup>1</sup>

| Samples        | Indicators on a 5-point scale |       |             |       | Average score |
|----------------|-------------------------------|-------|-------------|-------|---------------|
|                | Vux                           | Aroma | Consistency | Color |               |
| Control sample | 4,1                           | 3,9   | 4,5         | 3,8   | 4,07          |
| Prototype      | 4,7                           | 4,8   | 4,6         | 4,9   | 4,76          |

As can be seen from Table 1, walnut jam made with milk-ripe walnuts and natural mulberry syrup, replacing sugar syrup, improves the organoleptic properties of the finished product, as the average score for the test sample was 4.76, while the control sample scored 4.07.

For fruit jam, pH is an important parameter. According to our studies, the pH of the control samples was 4.2, while that of the test sample was 4.5. Thus, the addition of natural mulberry syrup shifts the pH toward an alkaline equilibrium.

Antioxidant activity was significantly higher in the batch with mulberry syrup (26.1 mg/g versus 18.4 mg/g) based on ascorbic acid equivalents (Figure 1).

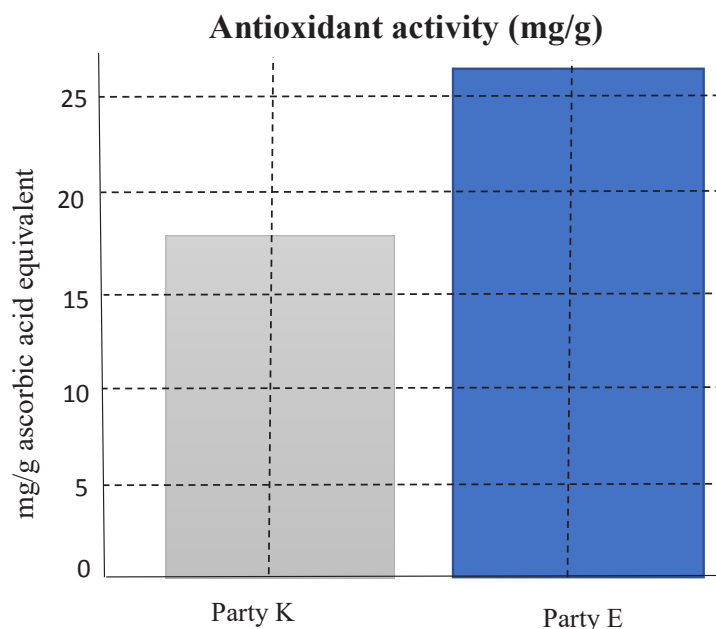


Figure 1. Antioxidant activity<sup>2</sup> (mg/g)

<sup>1</sup> Source: Developed by the author.

<sup>2</sup> Source: Developed by the author.



After 30 days of storage at 40°C, none of the batches showed signs of microbiological spoilage.

Mulberry syrup improves the flavor, aroma, and nutritional value of unripe walnut jam. The results indicate that mulberry syrup can be used as a substitute for sugar syrup when making jam from unripe walnuts. The main advantages of using mulberry syrup include:

- improved organoleptic characteristics due to fruity notes and mild caramelization;
- increased antioxidant activity of the product, which is important for functional nutrition (Gursoy, N, 2019; Molyneux, P, 2004);

- reduced glycemic load, especially important for consumers with limited sugar intake (Livesey, G, 2003).

It has also been noted that mulberry syrup is able to preserve the structural integrity of the nuts, preventing their tissue breakdown during cooking, which may be due to its gentle composition and acidity.

## CONCLUSIONS AND SUGGESTIONS

The use of mulberry syrup in the preparation of unripe walnut jam enhances the product's nutritional and consumer value and improves its organoleptic properties. The obtained data confirm the potential of mulberry syrup as a natural sugar substitute in the food industry, particularly within the context of the trend toward functional and healthy foods.

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## IQTISODIYOT & TARAQQIYOT

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