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ISIRGAN OTUNUN (URTİCA DİOİCA VE URTİCA URENS) RAF ÖMRÜNE ETKİSİNİN İNCELENMESİ "ISIRMAYAN KETÇAP"

INVESTIGATION OF THE EFFECT OF NETTLE (URTİCA DIOİCA AND URTİCA URENS) ON SHELF LIFE "KETCHUP WITHOUT BITE"

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Özet

Bu araştırmada günümüzde birçok insanın da sıklıkla fast food yiyeceklerin yanında ve içeriğinde sos olarak tükettiği hazır ketçabın, zararlarını göz önünde bulundurarak ona alternatif, katkısız, tamamen doğal bir sos (ketçap) üretimi yapmak amaçlanmıştır. Bireylerin kişisel ihtiyacı olan beslenme, hazır gıdalar yüzünden büyük bir tehdit altındadır. Bu tehdidin insan vücudunu doğrudan etkilediği araştırmalar sonucunda ortaya konmuştur. Yapılan çalışmalar incelendiğinde kişilerin bu zararları çok da bilmediği ortaya çıkmıştır**.** Bu nedenler doğrultusunda ketçapta kullanılan maddelerin oranları tespit edilerek kullanılan katkı maddeleri yerine doğal veya daha az işlenmiş maddeler kullanılmıştır. En önemlisi ise raf ömrünü uzatan katkı maddesi yerine antioksidan özelliğine sahip ısırgan otu kullanılarak üretilen sosun (ketçabın) raf ömrünün belirlenmesi amaçlanmıştır. Şifalı bitki olarak nitelendirilen ısırgan otu (Urtica dioica ve Urtica urens) , doğal yapısında bulunan lesitin sayesinde bir koruyucu görevi gördüğü yapılan araştırmalar neticesinde belirlenmiştir. Isırgan otu (Urtica dioica ve Urtica urens) hem koruyucu hem de şifalı yapısı sayesinde, birçok paketli gıdada koruyucu olarak kullanılan gıda katkı maddeleri yerine kullanılabileceği düşünülmüştür. Amaç, İnsanları katkı maddelerine maruz bırakmadan da istedikleri yiyecekleri yiyebileceklerini göstermektir. Bireylerin sağlığını korumak ve daha temiz bir gelecek inşa etmek temel ilke edinilmiştir. Sosların yapım aşamasında steril koşullara dikkat edilmiştir. Hazır soslara (ketçaplara) benzer şekilde tat, koku ve kıvam elde edilmeye çalışılmış, ısırgan otunun (Urtica dioica ve Urtica urens) etkisini inceleyebilmek için iki ayrı sos (ketçap) hazırlanmıştır. Deney grubu olarak belirlenen sosa raf ömrünün korunması adına katkı maddesi yerine ısırgan otu konulmuştur. Kontrol grubuna ise herhangi bir katkı yapılmamıştır. Deney ve kontrol grubu olarak aynı koşullarda üretilen soslar raf ömürleri karşılaştırılmak üzere analize gönderilmiştir. Radix Analiz Laboratuvarının yolladığı analiz sonuçlarına göre hipotez doğrulanmış ve ısırgan otunun bulunduğu sosun ısırgan otu içermeyen sosa göre 23 gün daha uzun ömürlü olduğu kanıtlanmıştır. Bu sonuçlar doğrultusunda ısırgan otunun (Urtica dioica ve Urtica urens) önemli miktarda koruyuculuğa sahip olduğunu söylemek mümkündür. Hazırlanan sos için raf ömrünü uzatan katkı maddeleri yerine ısırgan otunun kullanılabileceği tespit edilmiştir. Bu anlamda alana katkı sağlayacağı düşünülmektedir.

Anahtar Kelimeler: Ketçap, Gıda Katkı Maddeleri, Raf Ömrü, Isırgan Otu.

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Abstract

In this study, we found that many people today also often eat fast food. and as a condiment with food and as an ingredient in the ketchup, and we have come up with an alternative, unadulterated, all-natural It is aimed to produce sauce (ketchup). Individuals' personal needs nutrition is under great threat from convenience foods. This threat is threatened by It has been revealed as a result of research that it directly affects the body. Made in When the studies are examined, it is revealed that people do not know these damages very much. emerged. For these reasons The proportions of the ingredients used in ketchup were determined and the additives used natural or less processed substances were used instead. En importantly, it has antioxidant properties instead of additives that prolong shelf life. the shelf life of the sauce (ketchup) produced using stinging nettle is aimed to be determined. Healing nettle (Urtica dioica and Urtica urens), which is characterized as a plant, natural lecithin in its structure acts as a preservative thanks to the lecithin. has been determined as a result of research. Nettle (Urtica dioica and Urtica urens) is both protective and healing thanks to the food additives used as preservatives in many packaged foods can be used instead of additives. Purpose, Contributing people that they can eat the food they want without being exposed to substances is to show Protecting the health of individuals and building a cleaner future is adopted as a basic principle. Pay attention to sterile conditions during the production of sauces has been made. Taste, odor and consistency similar to ready-made sauces (ketchup) In order to examine the effect of nettle (Urtica dioica and Urtica urens), two different sauces (ketchup) prepared. In order to protect the shelf life of the sauce determined as the experimental group nettle was substituted for the additive. The control group did not receive no additives were made. Produced under the same conditions as experimental and control groups sauces were sent for analysis to compare their shelf life. Radix Analyzer According to the analysis results sent by the laboratory, the hypothesis was confirmed and the sauce with nettles is 23 days longer than the sauce without nettles life span has been proven. In line with these results, nettle (Urtica dioica and Urtica urens) has a significant amount of protection it is possible to say. Additives that extend the shelf life of the prepared sauce nettle can be used instead of nettle. In this sense, the area will make a contribution.

Keywords: Ketchup, Food Additives, Shelf Life, Nettle.

1. GİRİŞ

1.1. Problem Durumu

Hayatın hızlı akışı içerisinde besin tercihlerimiz de hızla değişmektedir. (Karatepe, Ekerbiçer, 2017, s.165). Günümüzde hem zaman darlığından hem pratik olduklarından hem de çekici görüntüleri nedeniyle, üzerinde çok da fazla düşünmeden tükettiğimiz hazır yiyeceklerle, doğal besinlerden hızla uzaklaşıyoruz (Çalışır, Çalışkan, 2003, s. 194).

İnsanlar dünyada var olduğundan beri uyku, gıda, tedavi ve giyime ihtiyaç duymuştur. Beslenme de bu ihtiyaçlar arasında en temelidir. Hayatın hızlı akışından dolayı ortaya çıkan zaman darlığı ve pratik yemek arayışları paketli ürünlerin tüketimini arttırmıştır. Paketli gıdalar çekici görüntüleri ve lezzetleri sayesinde kendini sattırmakta ve bu durum doğal besinlerden uzaklaşmamıza neden olmaktadır.

Tüketilen paketli gıdalar uzun ömürlü, daha lezzetli ve daha çekici olabilsin diye içerisine katkı maddeleri eklenir. Tekle (2019-2020), Gıda katkı maddesini, “Besleyici değeri olsun veya olmasın, tek başına gıda olarak tüketilmeyen ve gıdanın karakteristik bileşeni olarak kullanılmayan, teknolojik bir amaç doğrultusunda üretim, muamele, işleme, hazırlama,

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ambalajlama, taşıma veya depolama aşamalarında gıdaya ilave edilmesi sonucu kendisinin ya da yan ürünlerinin, doğrudan ya da dolaylı olarak o gıdanın bileşeni olması beklenen maddeler" şeklinde ifade etmektedir.

Bu maddelerin ambalaj ve etiketlerde belirtilmesi gerekirken birçok marka bu konuda tüketiciyi yeterince bilgilendirmez. Çalışır, Çalışkan (2003)'a göre katıldığı belirtilen maddelerin ise; miktarlarının etiketlerdeki beyanlara ve mevzuata uygun olup olmadığı şüphelidir. Halkın çoğunluğu tükettiği gıdalarda katkı maddesi olduğundan habersizdir.

Halbuki Türk Gıda Kodeksi Yönetmeliği Madde 25' de belirtilen cümleye göre: Bir gıda katkı maddesinin kullanıcısı veya üreticisi, Bakanlığın talebi üzerine, o katkı maddesinin mevcut kullanımı hakkında bilgi vermek zorundadır (13/10/2023 Resmî Gazete).

Türk Gıda Kodeksi, firmaların paketli gıdalarda belirli bir miktar gıda katkı maddeleri bulundurabilmelerine izin verse de bu maddelerin bir süre sonra vücutta birikerek insan sağlığını tehdit edebilecek miktarlara ulaşabileceği, dokularda hasar meydana getirebileceği, kısaca insan için genotoksik olabileceği öngörülmektedir (Sarıkaya, R, Solak, K., 2003; Aktaran Özdemir, Turhan, Arıkoğlu, 2012, s.35). Bu maddeler, bulantı, kusma, ishal, egzama, ürtiker, irritabl barsak hastalığı, rinit, bronkospazm, anjioödem, eksfoliyatif dermatit, migren, anaflaksi, hiperaktivite ve diğer davranış bozuklukları da yaparlar (Tuormaa, T.E., 1994; Aktaran Karatepe, Ekerbiçer, 2017, s.166).

Oysa ki Türk Gıda Kodeksi Yönetmeliği Madde 7' de belirtilen ifadeye göre bir gıda katkı maddesi;

a. Mevcut bilimsel kanıtlara dayalı olarak önerilen katkı maddesinin kullanım miktarı tüketici sağlığı açısından güvenlik riski doğurmaması,
b. Kullanımının tüketiciyi yanıltmaması halinde, belirtilen miktarlar doğrultusunda kullanılabilir.

Hemen hemen her yerde, çoğu yiyeceğin yanında yenen ketçap, genellikle tek başına tüketilmez ancak patates kızartması, makarna ve fast food ürünleri ile tüketilmektedir (Collins, 1995; Aktaran Bıldır B., Demircan H., Oral R.A., 2018, s.158). Haliyle bu paketli gıdalar da katkı maddeleri içerir.

Sorbik asit ve benzoik asit ketçap ve mayonezde kullanılan koruyuculardır. Benzoik asit(E210-213) insanlarda astım ve alerjiye neden olabilmektedir (Tekle, 2019-2020). Benzoik asit sadece ketçapta değil; margarin, reçel ve jölelerde, bisküvi ve kek kremalarında, çeşitli soslarda, zeytin ezmesinde de kullanılan ve migren ataklarını tetikleyen bir maddedir (Bağcı, T., 1997; Aktaran Ünlü, Bayır, 2022, s.63).

Araştırmalar doğrultusunda daha temiz bir gelecek inşası için günlük hayatta tüketilen maddelerle katkısız bir ketçap üretilmiştir. Amaç, İnsanları katkı maddelerine maruz bırakmadan da istedikleri yiyecekleri yiyebileceklerini göstermektir. Sağlıklı gıda tüketmek herkesin temel hakkıdır. Fakat günümüzde ise doğal yiyecek bulmak epey zorlaşmıştır. Üreticilerin bilinçli olmadığı toplumlarda bu durum ciddi riskler oluşturmaktadır.

Örneğin Türkiye gibi kontrollerin yetersiz olduğu hem üreticinin hem de tüketicinin bilinçsiz olduğu toplumlarda daha büyük bir tehlike oluşturmaktadır (Çalışır, Çalışkan, 2003, s. 195).

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Gelecek nesillerimizin daha sağlıklı olabilmesi için kişileri gıda katkı maddeleri hakkında bilgilendirmeli, onları bu maddelerden olabildiğince uzak tutmalıyız. Her yaştan insanın sıklıkla da gençlerin tükettiği ketçap aslında hemen hemen her yerde yenilebilecek bir gıda olduğu söylenebilir. Bu nedenler çevresinde gıda katkı maddeleri ile üretilen ketçap yerine insan sağlığına zararı olmayan doğal bir çözüm ile ketçap üretimi yapılması gerekliliği düşünülmüştür.

1.2.Problem Cümlesi

Projedeki temel amaç düşünüldüğünde problem cümlesinin "Gıda katkı maddelerinin yerine alternatif ne kullanabilirim?" sorusu olduğuna karar verilmiştir. Bu temel soru neticesinde alt problemler ise:

- Isırgan otu, raf ömrünü uzatacak bir madde olarak ketçap içerisinde kullanılabilir mi?
- Isırgan otu ile hazırlanan ketçabın ömrü ne kadardır?

1.3.Araştırmanın/Projenin Amacı

Yapılan projede temel amaç, çocuk, genç ve yetişkin bireylerin yeme alışkanlıklarında yer etmiş olan katkı maddeleri ile üretilmiş ketçabın, zararlı etkilerini bertaraf etmektir. Bu genel amaçla ketçabın içerisinde kullanılan katkı maddeleri yerine doğal veya daha az işlenmiş maddeler kullanılmıştır. En önemlisi ise raf ömrünü uzatan katkı maddesi yerine antioksidan özelliğine sahip ısırgan otu kullanılarak üretilen ketçabın raf ömrünün belirlenmesi amaçlanmıştır. Bireylerin sağlığını korumak ve daha temiz bir gelecek inşa etmek temel ilke edinilmiştir.

1.4.Araştırmanın/Projenin Önemi:

Projede daha temiz ve sağlıklı bir gelecek inşa etmek için sıklıkla tüketilen bir gıda nasıl bir değişimle daha zararsız hale gelir diye düşünülmüştür. Bu düşünce aydınlığında araştırmalar yapılarak bu ürünün katkısız, doğal bir benzeri yapılmıştır. Bunun nedeni gıda katkı maddelerinin, problem durumunda da örneklerle açıklanan, insan sağlığına verdiği zararlardır.

Sıkça tüketilen paketli gıdalarda, onları daha cazip, lezzetli, kısacası ilgi çekici göstermesi için gıda katkı maddeleri kullanılır. Bu maddelerin insan vücuduna ne gibi zararlar verdiğini paketli gıdaların ambalajında yetersiz bilgi verilmesi yani tüketiciyi yetersiz bilgilendirmeleri nedeniyle de tüketici bilememektedir. Literatür taramalarında da görüldüğü gibi tüketicilerin gıda katkı maddeleri hakkında bilgi sahibi olmadıkları fakat buna rağmen katkı maddeli gıdaları tükettikleri görülmüştür.

Ayan, Çalışkan ve Çırak (2005) yaptığı araştırmada özellikle Karadeniz Bölgesinde yoğun olarak bulunan bitkinin (ısırgan otu) yapraklarının mineraller, klorofil, amino asitler, lesitin, karetenoidler, flavonoidler, steroller, taninler ve vitaminlerce zengin ve yüzyıllardan beri; ilaç, gıda, lif, boya ve kozmetik alanlarında kullanılmakta olduğunu dile getirmiştir.

Bu zarar ve hastalıkların önüne geçebilmek için raf ömrünü arttırabilecek ve aynı zamanda insan vücuduna zarar vermeyecek bir gıda düşünülmüş, yerine şifalı ot olarak ifade edilen ısırgan otu kullanılmıştır.

Isırgan otunun yapısı araştırıldığında lesitin içerdiği ve lesitinin bazı durumlarda viskoziteyi azaltma ve ürünün raf ömrünü uzatmada kullanıldığı görülmüştür (Kutluay, 2023).

Şifalı bitki olarak nitelendirilen ısırgan otu, doğal yapısında bulunan lesitin sayesinde bir koruyucu görevi görür. Yapılan araştırmalar ve analizler sonucu da bunu kanıtlar

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niteliktedir. Isırgan otu hem koruyucu hem de şifalı yapısı sayesinde, birçok paketli gıdada koruyucu olarak kullanılan gıda katkı maddeleri yerine kullanılabileceği düşünülmüştür.

Paketli gıdalar, günümüzde giderek daha fazla dikkat gerektiren bir konu haline gelmiştir. Paketli gıdaların verdiği zararlar araştırmalar doğrultusunda literatürde belirtilmiştir. Gıda ve gıda arzı güvenliği, tüm bireylerin sağlıklı bir yaşam sürdürmelerinde kritik bir role sahiptir. Sağlıklı beslenmek herkesin temel hakkı olup üretici ve tüketicilerin bu konuya dikkat etmesi gerekmektedir. Bu nedenler göz önünde bulundurulmuş ve hazırlanan üründe katkı maddesi olmaması yani insan vücuduna tehdit bir madde içermemesi amaçlanmıştır. Bu amaç doğrultusunda da gıdada koruyuculuk sağlaması için ısırgan otu kullanılmıştır.

1.5.Literatür Taraması

Feingold (1976), yaptığı çalışmada gıdalardaki renklendirici maddelerin davranış bozukluklarına yol açtığını belirtmiştir. Gıda katkı maddeleri ve benzeri kimyasalların, bazı çocuklarda hiperaktivite ve bazı nöropsikolojik bozukluklara yol açtıklarını bildirmişlerdir.

Yapılan bir araştırmada sodyum benzoatın uygulanan doz ve süresine de bakılarak embriyoların toplam ağırlık oluşumunda önemli seviyede azalmaya sebep olduğu söylenmiştir. (Karakahya ve Başımoğlu Koca, 2016, s.85).

Çok sayıda çalışmada, aşırı miktarda sentetik gıda katkı maddesi tüketmenin gastrointestinal, solunum, dermatolojik ve nörolojik reaksiyonlara neden olabileceği saptanmıştır (Erkmen, O. 2010; Aktaran Özgün, Küşümler, 2020, s.24).

Araştırmalara göre Ankara piyasasından sağlanan meyve sularında benzoik asit miktarının izin verilen değeri aştığı saptanmıştır. Benzoik Asit (E210) astım, deri döküntüleri, hiperaktiviteye neden olabilen bir koruyucu katkı maddesidir (Yurttagün, M. 2010; Aktaran Boğa, Binokay, 2010, s.149).

Bilgin ve ark. (2022)'nın yaptığı çalışmada katılan katılımcılara gıda katkı maddeleri ile ilgili sorular yöneltilmiş, gıda katkı maddelerinin güvenli olup olmadığı sorulmuş ve %32,9'u güvenli bulurken %67,1'i güvenli bulmamıştır. Güvensiz bulanlar sağlığa karşı zararlı olduğunu düşüklerini ifade etmişler. Katılımcılara gıda katkı maddeleri hakkında yeterli bilgiye sahip olup olmadıkları sorulduğunda ise %22'si evet derken %78'i hayır cevabını vermiştir. Hayır diyenlerin çoğu bunun nedenini yetersiz eğitimden kaynaklı olduğunu söylemiş. Bireylere etiketler üzerinde ifade edilen E kodunun anlamı sorulduğunda ise %39'unun bildiği %61'inin bilmediği görülmüştür. Yapılan bu çalışmada insanların gıda katkı maddelerini çok da bilmedikleri halde bu maddeleri içeren paketli gıdaları tükettikleri görülmektedir.

Fast food ürünler hem lezzetli oldukları hem de zamandan tasarruf sağladıkları için tüketiciler tarafından tercih edilir. Bulut ve Kenanoğlu (2022)'nun yaptığı ankete katılan katılımcıların %28,4'ü Haftada 3-5 kez fast food yediğini söylemektedir. Aynı zamanda tüketicilerin %45,0'inin marketlerde satılan fast food ürünlerini satın aldıkları da belirlenmiştir.

Yapılan bir çalışmada birçok yemekte kullanılan salçaların içerisinde gıda katkı maddelerinin miktarının Türkiye Gıda Kodeksi Gıda katkı maddeleri yönetmeliğinin kabul gördüğü sınıra uyup uymadığı kontrol edilmesi istenmiştir. Coşkun ve Çotra (2019)'nın yaptığı çalışmada 5 adet geleneksel salça incelenmiş ve 1 örnekte koruyucu olarak kullanılan sorbik asit miktarının sınırı aştığı görülmüştür. Aynı araştırmacıların incelediği 5 ticari salçada ise 3'ünde limit değerin aşıldığı fark edilmiştir. Bu durumun önüne geçmek için yöneticilerin sık sık paketli ürünleri kontrol etmesi faydalı olacağı düşünülmektedir.

Balakar (2023)'ın yaptığı bir çalışmada organik fındığın konvansiyonel fındıktan daha az acılaşma, daha fazla lezzet ve genel beğeni puanlarına sahip olduğunu, renk ve koku

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değerlendirme puanlarının ise konvansiyonel fındığa benzer olduğunu gözlemlemiştir (Balakar, 2023, s.2). Yapılan bu projenin amacı: organik fındıkların ömrünü belirleyen parametreleri, kimyasal bileşenleri ve duyusal özellikleri inceleyip konveksiyonel fındık ile farkı olup olmadığını ortaya koymaktır.

Arslan (2021)'ın yaptığı çalışmada hayıt tohumu tozu kullanımının fizikokimyasal, toplam fenolik içerik, antioksidan özellikleri ve oksidasyon stabilitesi özelliklerinde olumsuz bir etki gözlenmeden doğal katkı maddesi ilaveli köfte üretimine imkân verdiğini yani hayıt tohumu tozunun önemli miktarda antioksidan potansiyeline sahip olduğu görülmüştür.

Özpolat, Dikici, Koluman, Patır ve Çalıcıoğlu (2017)'nun yaptığı çalışmada kullanılan alabalıklarda, çalışmanın ilk gününden itibaren biberiye esansiyel yağı ile işlem gören gruplar ile kontrol grubu arasında istatistiki açıdan önemli farklılıkların olduğu görülmüştür. Muhafaza süresine bağlı olarak psikrofil bakteri sayısındaki artışın, kullanılan biberiye konsantrasyonundaki artışa bağlı olarak daha az olduğu görülmüştür. Bu durum biberiye esansiyel yağının bir antioksidan görevi gördüğünü ifade etmektedir.

Yapılan çalışmalarda ısırgan otu ekstresinin total antioksidan aktivitesinin, α-tokoferol (Musette ve ark., 1996; Aktaran Korkmaz F., 2010, s.13), BHA, BHT ve kuersetin (Gülçin ve ark., 2004; Aktaran Korkmaz F., 2010, s.13) gibi güçlü antioksidanlardan bile daha fazla olduğu görülmüştür.

Yapılan araştırmalar incelendiğinde gıda katkı maddelerinin zararlı olduğu, insanların bu konu hakkında yeterince bilgi sahibi olmadığı, bazı paketli ürünlerde kullanılan gıda katkı maddelerinin izin verilen miktarın üzerinde olduğu ve gıda katkı maddelerinin yerine doğal bitkilerin kullanılabileceği görülmektedir.

2. YÖNTEM

Araştırmanın yöntemi Nicel araştırma türlerinden Gerçek Deneysel olarak tasarlanmıştır. Deney grubu olarak ısırgan otu konulan ketçap, kontrol grubu olarak ise üretilen ketçabın ısırgan otu konulmamış hali belirlenmiştir. Isırgan otunun raf ömrüne etkisi belirlenmek istenmiştir.

Ağustos ayında başlanan ketçap üretiminde, kullanılan bütün ürünlerin taze olmasına önem verilmiştir. Domateslerin sulu ve lezzetli olması için Ankara'nın Ayaş ilçesinden alınmış, beyaz şeker yerine daha az işlemden geçen ve mineral bakımından daha zengin olan esmer şeker kullanılmış, ketçaptaki asit düzenleyicisi yerine el yapımı olan ev yoğurdunun suyu kullanılmış, kıvamının hazır ketçaba benzemesi için az bir miktarda buğday nişastası kullanılmış aynı zamanda da ürün uzun süre kaynatılmıştır. Uzun ömürlü olması için tuz ve ısırgan otu kullanılmıştır. Baharatlandırmada kullanılacak malzemelere ise tamamen hazır ketçaba benzemesi göz önünde bulundurularak karar verilmiş ve bunun için sirke, karabiber, tarçın ve pul biber kullanılmıştır.

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Tablo 1

Projede hazırlanan ketçabın içeriği

Malzemeler:	**Miktarı:**
Domates	5 kilogram
Soğan	5 adet
Sarımsak	8 diş
Kapya biber	4.5 adet
Buğday nişastası	240 gram
Elma sirkesi	150ml
Esmer şeker	100 küp
Tuz	100 gram
Karabiber	20 gram
Tarçın	20 gram
Pul biber	20 gram
Yoğurt suyu	750ml

Tablo 2

Hazır ketçaplarda ve doğal ketçapta kullanılan ürünlerin karşılaştırması

Kullanılan GKM'nin Görevi	**Hazır ketçaplar**	**Doğal ketçap**
Kıvam arttırıcı	Modifiye Nişasta ve Ksantan Gum	Buğday Nişastası ve Kaynatma İşlemi
Asit Düzenleyici	Laktik Asit	Yoğurt Suyu
Koruyucu	Sodyum Benzoat ve Potasyum Sorbat	Tuz ve Isırgan Otu
Tatlandırıcı	Asesülfam ve Aspartam	Esmer Şeker

Diatek (2012)'in yaptığı çalışmada tüketilen hazır ketçapların içerisinde kıvam arttırıcı olarak modifiye nişasta ve ksantan gum kullanılırken bu araştırmada yapılan ketçapta ise buğday nişastası ve gıdayı kaynatma işlemi bu görevi görmektedir. Asit düzenleyici olan laktik asit yerine yoğurt suyu; koruyucu olarak kullanılan sodyum benzoat ve potasyum sorbat yerine tuz ve ısırgan otu; tatlandırıcı olan asesülfam ve aspartam yerine ise beyaz şekere nispeten daha mineralli olan esmer şeker kullanılmıştır.

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Yapılan araştırmalar sonucunda 2024 senesinin ağustos ayında ketçaplar hazırlanmış ve oda koşulunda incelendiğinde gözle görünür değişiklikler tespit edilmiştir. İncelemeler sonucunda bir ay sonra ısırgansız ketçabın (Kontrol grubu) küflendiği, 15-20 gün sonradan da ısırganlı ketçabın (Deney grubu) küflendiği görülmüştür. Bu sonuçtan yola çıkılarak tekrardan hazırlanan sosların analize gönderilmesine karar verilmiştir.

Steril bir şekilde hazırlanan ve içeriğinde katkı maddesi bulunmayan doğal ketçap iki ayrı şekilde hazırlanmıştır. Tablo 1'de belirtilen malzemeleri içeren ketçap, önceden kendisinin ve kapağının kaynatıldığı cam kavanozun (330ml) içerisine konulmuş ve ağzı sıkıca kapatılmıştır. Geriye kalan ketçabın içerisine bahar aylarında dışarıdan toplanan ve kurutulan ısırgan otundan 80g eklenmiş ve aynı işlemler bu ketçap için de tekrarlanmıştır. Ağzı vakumlu numuneler (Isırganlı 750ml – Isırgansız 330ml) analiz için paketlenmiş ve Tarım ve Orman Bakanlığına bağlı olan Radix Analiz Laboratuvarına gönderilmiştir.

3. BULGULAR

Tablo 3

35. Gün ısırganlı ketçap (deney grubu) analiz sonuçları

Analiz	Sonuç	LOD/LOQ	Ölçüm Belirsizliği (±)	Geri Kazanım (%)	Cihaz	Analiz Metodu	Limit	Limit Kaynağı	Değerlendirme
1-Duyusal Özellikler (Organoleptik Muayene)-Tat Koku Hariç	Kendine özgü renk, görünüş ve yapıdadır.	/				TS EN ISO 5492			DY
2-*pH	4,25	/	0,04			NMKL 179			DY
3-*Aerobik Koloni Sayımı (kob/g)	<10	/				ISO 4833-1			DY
4-*Maya ve Küf Sayımı (kob/g)	<10	/				ISO 21527-1			DY
5-*Koliform Bakteri Sayımı (kob/g)	<10	/				ISO 4832			DY

Tablo 4

35.Gün ısırgansız ketçap (kontrol grubu) analiz sonuçları

Analiz	Sonuç	LOD/LOQ	Ölçüm Belirsizliği (±)	Geri Kazanım (%)	Cihaz	Analiz Metodu	Limit	Limit Kaynağı	Değerlendirme
1-Duyusal Özellikler (Organoleptik Muayene)-Tat Koku Hariç	Kendine özgü renk, görünüş ve yapıdadır.	/				TS EN ISO 5492			DY
2-*pH	4,20	/	0,04			NMKL 179			DY
3-*Aerobik Koloni Sayımı (kob/g)	<10	/				ISO 4833-1			DY
4-*Maya ve Küf Sayımı (kob/g)	<10	/				ISO 21527-1			DY
5-*Koliform Bakteri Sayımı (kob/g)	<10	/				ISO 4832			DY

Tablo 2 ve Tablo 3 incelendiğinde ısırganlı ketçabın (deney grubu) 35. günde hala bozulmadığını fakat ısırgansız ketçabın (kontrol grubu) sınır kabul edilen pH değeri 4.2'ye ulaştığı görülmüştür. Isırgansız ketçabın (kontrol grubu) pH değerindeki düşüşten dolayı analizi sonlandırılmıştır.

Tablo 5

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Isırgansız ketçabın (kontrol grubu) analiz sonuçları

Isırgansız Ketçap	Standart Değerler	1. gün	8. gün	15. gün	20. gün	35. gün		
Duyusal Kontrol	Homojen görünümde ve kendine özgü renkte olmalı, ambalaj açıldığında ketçap yüzeyinin renginde koyu kahverenginden siyaha kadar değişen belirgin renk değişikliği olmamalıdır.	Kendine özgü renk, görünüş ve yapıdadır.	Kendine özgü renk, görünüş ve yapıdadır.	Kendine özgü renk, görünüş ve yapıdadır.	Kendine özgü renk, görünüş ve yapıdadır.	Kendine özgü renk, görünüş ve yapıdadır.		
pH	3,5-4,2	4,22	4,24	4,24	4,21	4,20		
Salmonella	Bulunmamalı	TE						
Maya ve Küf	10^3	<10	<10	<10	<10	<10		
Aerobik Koloni Sayımı		<10	<10	<10	<10	<10		
Koliform Bakteri		<10			<10	<10		
Rapor No		**5731**	**5899**	**6043**	**6134**	**6521**		

Tablo 6

Isırganlı ketçabın (deney grubu) analiz sonuçları

Isırganlı Ketçap	Standart Değerler	1. gün	8. gün	15. gün	20. gün	35. gün	47. gün	58. gün
Duyusal Kontrol	Homojen görünümde ve kendine özgü renkte olmalı, ambalaj açıldığında ketçap yüzeyinin renginde koyu kahverenginden siyaha kadar değişen belirgin renk değişikliği olmamalıdır.	Kendine özgü renk, görünüş ve yapıdadır.	Kendine özgü renk, görünüş ve yapıdadır.	Kendine özgü renk, görünüş ve yapıdadır.	Kendine özgü renk, görünüş ve yapıdadır.	Kendine özgü renk, görünüş ve yapıdadır.	Kendine özgü renk, görünüş ve yapıdadır.	Kendine özgü renk, görünüş ve yapıdadır.
pH	3,5-4,2	4,25	4,27	4,26	4,25	4,25	4,24	4,22
Salmonella	Bulunmamalı	TE						
Maya ve Küf	10^3	<10	<10	<10	<10	<10	<10	<10
Aerobik Koloni Sayımı		<10	<10	<10	<10	<10	<10	<10
Koliform Bakteri		<10			<10	<10	<10	<10
Rapor No		**5730**	**5898**	**6042**	**6133**	**6520**	**6959**	**52**

Analiz sonuçları incelendiğinde ısırganlı ketçabın, ısırgansız ketçaba kıyasla 23 gün fazla dayandığını söylemek mümkündür.

4. SONUÇ, TARTIŞMA VE ÖNERİLER

4.1. Sonuç

İki ayrı ketçap için fiziksel, kimyasal ve mikrobiyolojik analizler yapılmıştır. Mikrobiyolojik analiz sonuçlarına bakıldığı zaman ürünlerde herhangi bir mikrobiyolojik üreme görülmediği anlaşılmaktadır. Duyusal kontrollerde ürünlerde herhangi bir renk değişimi, yapısının bozulması gibi bir durum olmadığı belirtilmiştir. Koku paramatresi yer almamasına ragmen 30. günden sonra ısırgansız ketçapta bir koku ortaya çıktığı belirtilmiştir.

Kontrol parametrelerinden biri de pH analizidir. Yapılan kontrollerde Isırgansız ketçabın 35.gün kontrolünde pH değerinin 4,20'ye geldiği görülmüştür. 4,20 değeri sınır olarak belirlenmiştir. Üründe hissedilebilir derecede bir koku da olduğunu göz önüne alındığında, üründe bozulmanın başladığı kanaatine varılmıştır. Kontrollerde 36. günde pH analizini tekrarlandığında değerin 4,11'e geldiği görülmüştür. pH'ın bu şekilde düşmesiyle ve koku sebebiyle üründe bozulmanın başladığı kanaatine varılmış ve ısırgansız ketçabın(kontrol grubu) analizi sonlandırılmıştır.

Isırganlı ketçapta ise herhangi bir koku veya pH değerinin aşırı düşmesi gibi bir durum ile karşılaşılmamıştır. Yapılan ara kontrollerde 58. güne kadar üründe herhangi bir bozulma belirtisi görülmemiş olduğu belirtilmiştir. Zaman darlığı nedeniyle 58. günde ısırganlı ketçabın analizi de durdurulmuştur.

Arslan (2021)'ın yaptığı çalışmada hayıt tohumu doğal bir antioksidan madde görevi görmekte ve yapılan bu projeyle benzer sonuç göstermektedir.

Balakar (2023)'ın yaptığı çalışmada ise organik fındığın konveksiyonel fındıktan daha lezzetli ve uzun ömürlü olduğu söylenmiştir. Isırgan otu hipotezi bu projeyi desteklemektedir.

Özpolat ve ark. (2017)'nın yaptığı çalışmada kullanılan biberiye esansiyel yağının bir antioksidan görevi gördüğü söylenmiştir. Bu durum yapılan bu projeyle benzer sonuç gösterir.

Analizlerin sonucu incelendiğinde ısırgan otunun raf ömrünü uzattığı ispatlanmıştır. Isırgan otunun bulunduğu ketçabın (deney grubu) ısırgan otu içermeyen(kontrol grubu) ketçaba göre 23 gün daha uzun ömürlü olduğu kanıtlanmıştır. Araştırmanın alt problemlerine cevap bulunmuştur. Yapılan bu araştırmanın alana katkı sağlayacağı düşünülmektedir.

4.2. Öneriler

- Tüketicileri gıda katkı maddelerinin ne olduğu ne gibi zararlar verdiği hakkında bilgilendirmek amacıyla okullarda bununla ilgili sunumlar veya afişler hazırlanması önerilmektedir.
- Isırgan otu hem sağlıklı yapısı sayesinde hem de bir koruyucu görevi gördüğü için hazır soslar ve benzeri paketli gıdalarda kullanılabilirliğinin test edilmesi önerilmektedir.
- Diğer katkı maddeleri yerine kullanılabilecek bitkisel çözümler denenmesi önerilmektedir.

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KİRAZ ÜRETİMİNDE İŞGÜCÜ: SORUNLAR VE ÇÖZÜM ÖNERİLERİ

LABOR IN CHERRY PRODUCTION: PROBLEMS AND SOLUTION PROPOSAL

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Özet

Kiraz, lezzeti ve besleyici özellikleri ile dünya genelinde sevilerek tüketilen meyvelerdendir. Türkiye de iç tüketim ve ihracat bakımından öncelikli ürünlerdendir. Kiraz üretimi dağlık bölgelerde yaygın, yoğun işgücü gerektiren bir tarımsal faaliyettir. Bu çalışma da kiraz üretiminde işgücünün rolü, karşılaşılan iş güvenliği, kalifiye işgücü kapsamındaki sorunlar hakkında veriler değerlendirilmiştir. Bu sorunlara yönelik çözüm önerileri ele alınmaktadır. Başta budama, hasat, seçme ve paketleme olmak üzere işgücünün ağırlıklı kullanıldığı kiraz üretim işkolundaki hassas tarım teknikleri doğrultusundaki fırsatlar araştırılmıştır. Kiraz hasadında, hassas bir meyve olduğu için elle, hassas titizlikte toplanması zorunludur. Büyük gruplar halinde kısa hasat sezonunda nitelikli işgücü kapasitesi gerektiren bileşenleri planlamayı gerektirir. Türkiye'deki yaygın kiraz anaç ve çeşitleri klasik ve geniş taçlı formdadır. Bu durum hasat ve budama da işçiliği zorlaştırmaktadır. Mekanizasyon olanakları, eğitim ve yayım, işbirligi ve doğru uygulanabilir stratejilerin önerilmesi hedeflenmektedir. Kiraz üretiminin sürdürülebilirliği ve rekabet edebilirliği artıracak işgücü yönetimi, tarım politikalarının önemli bir parçası haline getirilmelidir.

Anahtar kelimeler: Kiraz, Türkiye, hasat, işgücü

Abstract

Cherry is one of the fruits consumed all over the world with its taste and nutritional properties. It is one of the priority products in terms of domestic consumption and export in Turkey. Cherry production is a common agricultural activity in mountainous regions that requires intensive labor. In this study, data on the role of labor force in cherry production, occupational safety problems encountered and problems within the scope of qualified labor force were evaluated. Solution suggestions for these problems are discussed. Opportunities for precision agriculture techniques in the cherry production sector, where labor force is predominantly used, especially pruning, harvesting, selection and packaging, were investigated. In cherry harvesting, it is necessary to collect it by hand with precision and meticulousness, as it is a delicate fruit. It requires planning components that require qualified labor capacity in large groups during the short harvest season. Common cherry rootstocks and cultivars in Turkey are in the classical and

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wide-crowned form. This situation makes harvesting and pruning difficult. Until there is mechanization

Keywords: Cherry, Türkiye, harvest, labor force

1.GİRİŞ

Türkiye ekolojik avantajları sayesinde birçok bitki çeşitliğine sahip bulunmaktadır. Bu anlamda dünyanın nadir ülkeleri arasında yer almaktadır. Bu bitkiler içerisinde bahçe bitkileri önemli bir yer kaplamaktadır. Meyvecilik Anadolu da çok eski zamanlardan beri devam eden bir kültürdür. Bu kültür zenginliğinin sebepleri arasında ekoloji yanında yaşam şartlarının etkisi, geçim kaynağı ve beslenme ön plana çıkmıştır. Sonuçta birçok meyve türü üretilmekte, ekonomik faaliyet alanında yer almaktadır. Ekolojik farklılıklar değişik meyve türlerinin de coğrafi olarak kümelenmeye neden olmuş o bölgelerde sektörel gelişmeler daha yoğunlaşmıştır son yıllarda meyve üretiminde teknolojik gelişmeler ve üretim tekniklerinde önemli gelişmeler kaydedilmiştir. Türkiye dünya kiraz üretiminde birinci sırada yer almakta İran ve ABD ise ilk üç sırada bulunmaktadır (Kaşka vd. 2005). Türkiye'de 2022/23 Pazarlama Yılı (MY) için toplam kiraz üretim tahmini 980.000 metrik tondur (MT), bu yılki elverişli hava koşulları ve artan verim nedeniyle 2021/2022 MY'den yüzde 14 daha fazladır(USDA.2022).

Türkiye de üretimi yapılan meyve türleri arasında, iklim özellikleri açısından ılıman olarak ve pomoljik olarakta sert çekirdekli meyve türleri arasında konumlandırılan kiraz; Bilimsel sınıflandırmada (*Purunus avium L.)*'ın taksonomisi incelendiğinde, Rosaceae familyası, Prunoideae alt familyası, Prunus cinsi içerisinde yer aldığı belirtilmektedir (Öz, 1998). Kiraz bitkisinin anavatanı Güney Kafkasya, Hazar Denizi ve Kuzeydoğu Anadolu coğrafyası orjin olarak bilinmektedir. Bu bölgelerden, Dünya'nın diğer alanlarına doğru büyük bir üretim alanına sahip olmuştur. Birçok meyve türünde olduğu gibi kirazın (*Purunus avium* L.) da en eski kültür alanlarından biri Anadolu'dur. Dolayısıyla Anadolu kirazın orjin merkezlerinden biridir. Kiraz Anadolu dan Avrupaya ve diğer alanlara da buradan çeşitli kaynaklar vasıtasıyla dağılmıştır (Özbek, 1978).

Türkiye, ılıman iklim meyve türlerinde ve sert çekirdekli meyvelerin üretiminde son yıllarda önemli mesafede yol almıştır. Meyve üretimi yanında dünyanın önemli üretici ülkeleri arasında üretim miktarı ve ihracat konusunda önemli bir potansiyele sahip olduğu, ürün pazarlaması yanında üretim sezonunun uzun olması özellikle ekolojik avantajın birçok bölgede kiraz yetiştiriciliğine imkan sunduğu bildirilmektedir. Türkiye de kiraz üretiminin özellikle Eğe ve iç Anadolu bölgelerinde yoğunlaştığı bildirilmektedir (Çelik ve Sarıaltın,.2019).

Bölgelere göre kiraz üretimini etkileyen faktörlerden birisi de coğrafi yapıdır. Herhangi bir alanda meyvecilik yapmadan önce bahçe tesisini etkileyen faktörlerin iyi analiz edilmesi gerekmektedir. Arazi şartları, iklim, pazarlama gibi ekolojik ve ekonomik parametrelerin değerlendirilmesi ve bu şartlara göre karar verilmesi gerekmektedir. Bahçe tesisi aşamasında yapılacak hatalar meyvecilik sektörünün uzun vadeli bir yatırım olduğu göz önüne alınırsa, bir çok ekonomik kayıplara sebep olması muhtemeldir. Dolayısıyla bahçe tesis aşamasında dikkatli olunması ileride karşılaşılabilecek sorunların engellenmesi gerekmektedir. Kiraz bahçesi tesisinde de bölgeye uygun anaç çeşit seçimi, toprak işleme, hastalık ve zararlı mücadelesi, budama ve hasat gibi kültürel uygulamaların sağlıklı planlanması gerekmektedir. Kullanılacak alet ve ekipmana göre dikim sistemlerinin kullanılması, gerekli iş gücü ve enerji temini ve sonunda birim alandan en ekonomik kazancın hedeflenmesi gerekmektedir (Ağaoğlu vd. 2010).

Birçok meyve üretiminde olduğu gibi kiraz üretiminde bahçe tesisinden itibaren üretim sürecince birçok girdi kullanılmaktadır. Bitki besleme için gübreler ve diğer kimyasallar,

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hastalık ve zararlı mücadelesi için ilaçların yanında kültürel uygulamalar için enerji ve işgücü üretimin temel organlarını oluşturmaktadır. Özellikle son yıllarda maliyetin azaltılması birim alandan yüksek ve kaliteli meyve üretimi hedeflenmekte ancak üretimi faaliyetlerinde kullanılacak işgücünün kalifiye ve yeterli miktarda temin edilmesi üretimin temelini oluşturmaktadır. Özellikle kiraz gibi işlemeye hassas yapısı ve kalite kriterlerinin ön plana çıktığı, ihracatta önemli bir potansiyelin olduğu, dünya üretim ve pazarında dikkate değer bir yere sahip olduğumuz öncelik olarak alınırsa; kullanılan işgücünün kalifiye ve ekonomik olması istenir. Diğer taraftan işgücü, üretim alanında temin edilebilirliği, nitelikli olup olmaması ve kullanılan mekanizasyon ile teknolojinin kullanılabilirliği gibi birçok etkenle ilişkili olabilmektedir.

Meyvecilik ehil, nitelikli ve uzman işgücüne mutlak ihtiyaç duymaktadır. Birçok tarımsal üretime kıyasla daha fazla insan emeği gerektirir Günümüzde tarım sektöründe karlılık kümelenmiş ve mekanize üretime bağlıdır. Son yıllarda Kiraz üretiminde işgücünün risk oluşturduğu ekonomik evreler yaşanabilmektedir.

2-Dünya Kiraz üretim ve Ticaretinde Türkiye'nin Yeri

Dağlık coğrafyasındaki kırsal işgücü potansiyeli halen Türkiye'yi Kiraz üretiminde geleneksel rolde bir üretici ülke olarak tarım alanında öne çıkarmaktadır.

Türkiye, 2020 üretim yılı dünya kiraz üretim alanı ve üretim miktarı sıralamasında ilk sırada yer almaktadır. Dünya kiraz ihracatı 2020 yılında bir önceki yıla göre %4,4 oranında artarak 812 bin tona yükselmiştir. Ülkeler itibariyle 2020 yılı verilerine göre kiraz ihracatı incelendiğinde en fazla kiraz ihracatı yapan ilk üç ülke 274 bin ton ile Şili, 165 bin ton ile Hong Kong, 87 bin ton ile Türkiye'dir. 2020 yılında bu üç ülke dünya kiraz ihracatının %64,7'sini gerçekleştirmiştir. Türkiye ise kiraz ihracatında %10,7 ile dünyada 3. sırada yer almaktadır. Dünya kiraz ithalatı 2020 yılında bir önceki yıla oranla %1,4 oranında azalarak 724 bin tona düşmüştür. Dünya kiraz ithalatında önde gelen ülkelerin payları incelendiğinde ise % 29 ile Çin, %20,2 ile Hong Kong, %12 ile Rusya, %7 ile Almanya ve %3,5 ile Kanada gibi ülkelerin ithalat oranlarının yüksek olduğu görülmektedir. Kiraz ithalatında en yüksek pay yaklaşık 210 bin ton ile Çin'e ait olup, Çin'i 146 bin ton ile Hong Kong izlemektedir(TEPGE.2022).

Günümüzde işkollarında inşa süreci kadar sürdürülebilirlik modernizasyonu da önemlidir. Türkiyenin kiraz üretim ve ticaretindeki Dünya'daki rolünü koruyabilecek ve artıracaktır. Bilinçli güncellemeler ve yaygınlaştırılan doğru uygulamalar üretim ve pazarlama süreçlerine gecikmeden uyarlanmalıdır.

Üretimde ilk sırada olmamıza rağmen ihracat oranımız düşük, yüzde 12-13 kadar. Yani 80 bin ton civarında. Oysaki Şili ürettiği kirazın yüzde 80'ini, Yunanistan yüzde 30'unu, ABD yüzde 25'ini ihraç ediyor. Bizde ihracat oranı düşük olmasına rağmen üretimin lokomotifini yine ihracat oluşturuyor. İklim özellikleri bakımından oldukça seçici bir meyve olan kirazın uluslararası pazarda yüksek fiyatlar bulması sebebiyle hem üretici hem de ihracatçılar açısından potansiyeli yüksek (TÜRKTARIM.2023).

Bu çalışmada kiraz üretiminde kullanılan faktörlerden işgücünün sorunları ve çözümleri değerlendirilmeye çalışılmıştır.

3. Kiraz Üretiminde İşgücünün Nitelikli Olarak Gerektiği Bakım İşleri

Tarımsal işletmelerin planlanması ve yönetiminde doğa, sermaye, işgücü girişimci tarafından planlanmaktadır. Kiraz üretiminde aşağıdaki başlıklarda işçiliğin önceliği bulunmaktadır.

3.1-Bahçe Tesisi: Yeni tesis edilecek alanlarda dikim sistemlerine göre anaç ve çeşit şeçimi, modern işlemlere elverişli fidan dikim şekli, ilk şekil budaması, sulama altyapısı ve gübreleme

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sistemlerinin fertigasyona (sulamayla gübreleme) uygun kurulması gibi altyapı tesislerinin kurulması doğru temellerde işin başlatılmasıdır.

3.2-Şekil ve Ürün Budaması: Ağaçların ilk yıllarda şekil alması ve daha sonraki yıllarda kaliteli ürün almak, sağlıklı büyümesi ve verimliliğinin artırılması için düzenli her ağaca özel budama gereklidir.

3.3-Hastalık ve zararlı Mücadelesi: Ürünün sağlıklı olması ve kirazda sıkça yaşanabilen kalıntı sorunlarının bertarafı için yapılacak dozunda ve doğru ilaçlama, yabancı ot mücadelesi, alet ve ekipman kullanımı için gerekmektedir.

3.4-Mekanizasyon: Toprak işleme, nakliye, sulama, gübreleme, kültürel uygulamalar da insan işgücünü en aza indirecek makine, ekipman ve cihazlar kullanılmalıdır.

3.5-Tozlaşma, polinasyon, döllenme: Kiraz ağaçlarının verimli bir şekilde meyve vermesi için çiçeklenme öncesi tozlaşma sürecinin 2- 5 dekara 1 koloni arının bahçede bulundurulmasıyla gerekir. Bu süreçte sıkça kullanılan bal arıların (Apis mellifera L.) yanı sıra insan emeği de hazırlık, kontrol yönünden takip önemlidir.

3.6- Hasat: Kiraz, hassas, yumuşak dokulu ve berelenme hassasiyeti olan bir meyve olduğu için elle toplanması gerekir. Bu da belirli zaman aralığında büyük çaplı ehil işgücü kapasitesi gerektirir.

3.7-Hasat sonrası işlemler: Seçme, Ayıklama ve Paketleme, Toplanan kirazların boyut, renk ve kalite açısından sınıflandırılması ve paketlenmesi muhafaza işlemleri de yoğun emek ister.

4. Kiraz Üretiminde İşgücü Sorunları

Kiraz üretiminde işgücüne bağlı olarak ortaya çıkan başlıca sorunlar şunlardır:

4.1. Kiraz üretiminde verimliliği artırmak için nitelikli işgücüne ihtiyaç vardır. Ancak bu alanda eğitimli ve deneyimli işçi bulmak sezonluk oluşan talep dolayısıyla zordur. Sezonluk ve geniş çaplı işgücü eksikliği yaşanmaktadır. İşgücü bütün yıl iş imkânı devam eden dengeli istihdamı öncelikle tercih edecektir.

4.2. Kırsal alanlardan kentsel bölgeler göçün artması, kiraz üretiminin yapıldığı dağlık ve kırsal alanlarda çalışacak işgücünün azalmasına neden olmaktadır. Genç nüfusun tarım sektörüne ilgisinin azalması, yaşlanan bir işgücü profili yaratmaktadır.

4.3. Kiraz üretim sezonunda sebzecilik ve tarla bitkileri üretiminde de mevsimlik İşçi ihtiyacı artmakta ve bu sorun işgücü teminini imkânını kısıtlamaktadır. Kiraz hasadı gibi beceri ve tecrübe gerektiren mevsimlik işlerde çalışacak işçi bulmak zorlaşmaktadır.

4.4.Mevsimlik işçilerin çalışma koşulları, ücretleri ve barınma imkanları yetersiz olabilmektedir.

4.5. İşgücü Maliyetlerinin Artması; İşgücü eksikliği, ücretlerin yükselmesine ve üretim maliyetlerinin artmasına neden olmaktadır.

Özellikle kiraz ihracatına yönelik üretim yapan üreticiler, rekabet gücünü nitelikli işgücü eksikliği sorunuyla kaybetme riskiyle karşı karşıyadır.

5. Hassas Tarım Tekniği Yaklaşımıyla Sunulabilecek Çözüm Önerileri

Mekanizasyon ve teknoloji kullanımı her sektörde olduğu gibi tarımda da kilit rol oynamaktadır. Kiraz üretiminde işgücü sorunlarını çözmek için mekanizasyonu artıran işgücünü azaltıcı yenilikçi şu öneriler sunulabilir.

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Hasat sürecinde mekanizasyonun artırılması, işgücü ihtiyacını azaltabilir. Örneğin, kiraz toplama makineleri ve otomatik ayıklama sistemleri kullanılabilir. Tarım teknolojileri (dronlar, sensörler vb.) ile üretim süreçleri daha verimli hale getirilebilir.

Bu önerileri somutlaştırdığımız da; aşağıda ki öneriler uygulanabilir destekleme politika ve yayım stratejisi temellerine katkımızı oluşturacaktır.

5.1-Kirazlarda Türkiye ekolojinde farklı toprak ve iklim şartlarına uygun işçiliği de kolaylaştıracak anaçların ıslahı yaklaşımı uzun vadede kiraz üretim stratejisinin temelini oluşturmalıdır.

5.2-Halen yaygın olarak kiraz bahçesindeki seçme insan gücüyle ve ilkel elek benzeri basit ekipmanlarla yapılmaktadır. İnsan işgücü sübjektif ve göreceli işçiye göre değişken performanslar bu aşamada farklılıklar oluşturmaktadır. Görüntü işleme tekniği ile seçme, ayıklama ve boylamada somut adımlar bahçe de toplama sonrası mobil makine ve cihaz tasarlanarak artırılmalıdır.

5.3-Bahçelerde nazikçe ve ustalıkla saplı özellikte koparılan kiraz meyvesi eğimli ve dağlık topografyalarda elle insan işgücüyle taşınmaktadır. İnsansız hava aracı-Dronlarla hasatta eğimli araziler deki bu nakliye, taşıma hasat edilen ağaç ve seçme merkezi arasında sağlanabilir.

5.4-Ürün tahmini ve fenolojik kontrollerde farklı görüş açılarından ağaç ve bahçe genelinde hızlı tespitler için görüntü işleme tekniğiyle dronlarla izleme yapılabilir.

5.5-Bitki koruma ve besleme ürünlerinin yapraktan uygulanmasında ürün dağılımındaki yoğunluğa göre dozlama için yazılım programları işçilik ve ilaç, gübre maliyetlerinde tasarruf sağlayacaktır.

6. İşgücü Politikalarının İyileştirilmesi

Türkiye ‘de kiraz üretiminde üreticiler emeklilik, başka sektörlerde sürekli istihdam olunma gibi geçim kaynaklarına sahip olunca kiraz üretimini ikincil veya yan iş olarak değerlendirmektedir. Kiraz sektörünün mevsimlik işçilerin çalışma koşullarının iyileştirilmesi, ücretlerin adil hale getirilmesi ve barınma imkânlarının artırılması, işgücü çekmek ve garantiye almak için gereklidir. Tarım işçilerine yönelik sosyal güvenlik ve sağlık hizmetleri sağlanmalıdır.

Eğitim Yayım ve Bilinçlendirme Çalışmaları etkinleştirilmelidir. Tarım sektöründe çalışacak gençler için eğitim programları düzenlenmeli ve tarımın cazip bir meslek haline getirilmesi sağlanmalıdır. Üreticilere yönelik modern tarım teknikleri ve işgücü yönetimi konularında eğitimler verilmelidir.

Göçmen işgücü politikaları tarıma uyarlanmalıdır. Türkiye’nin tarım sektöründe de kamuoyunda sıkça ifade edilen göçmen işçiler yadsınamaz gerçektir. Mevsimlik tarım işçisi ihtiyacını karşılamak için yasal göçmen işçi programları oluşturulabilir. Göçmen işçilerin hakları ve çalışma koşulları uluslararası standartlara uygun hale getirilmelidir.

7.Kooperatifleşme ve İşbirliği

Üreticilerin ortak iş yapabilme kültür ve bilinci sosyal bilimlerden de etkin destek alarak geliştirilmelidir. Müşterek ve kümelenmiş arazilerde havza bazında planlanan sivil toplum örgütleri ve kooperatifler çatısı altında kiraz üreticilerinin işbirliği olanakları geliştirilmelidir.

İşgücü organizasyonu ve dengeli paylaşımı adil olarak düzenlenebilir. Ortak mekanize ekipman parkı oluşturularak uzman ekip destekli alıcı ve satıcının sürekli takip edebileceği hasat organizasyonları gibi modeller geliştirilebilir. Böylece işgücü maliyetlerini düşürebilir ve kaynakların daha verimli kullanılmasını sağlayabilir.

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8. Sonuç ve Öneriler

Kiraz üretiminin yoğun ve nitelikli işgücü gerektirmesi ihracat odaklı planlamayı öngörmektedir. Türkiye'nin Dünya kiraz üretimindeki öncü rolü doğru stratejilerle kurgulanmalıdır. Hasat, budama alanlarında yaşanan işgücü sorunları üretim verimliliğini ve ekonomik karlılığı olumsuz etkilemektedir. Günümüz modern üretim teknikleri hassas tarım kavramı ve kapsamlı mekanizasyon çözümlerini kapsamaktadır. Tarımsal yayım ve eğitim kiraz üretiminde rol oynayan üretici, işgücü, ve uzmanları etkin buluşturmalıdır. Kiraz üretimindeki; Dünya pazar payındaki öncü rolü üretimi kötü durum senaryoları da dahil doğru matrikste planlayarak çözmek makuldür. Gelecek pazar tahminleri konusundaki belirsizlikler multidisipliner işbirliği ve doğru politikalar ile aşılabilir. Kiraz üretiminin sürdürülebilirliği için işgücü yönetimi niteliklendirilmelidir. Tarım politikalarının önemli bir parçası rekabet edebilirlik sektördeki işgücünün uygulamalı ve kapsamlı kontrol edilen yayım eğitimi ve bu eğitimin güncelliğini korumasıyla güçlendirilebilecektir.

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SYNERGISTIC EFFECTS OF ALUM AND POWDERED ACTIVATED CARBON ON THE REMOVAL OF NON-STEROIDAL ANTI-INFLAMMATORY DRUGS BY COAGULATION–FLOCCULATION

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Abstract

This study aimed to enhance the removal of non -steroidal anti-inflammatory drugs during coagulation-flocculation in the presence of aluminum sulfate alone and then in combination with powdered activated carbon. The Jar-Test was performed in the laboratory on aromatic organic compound (diclofenac) dissolved in distilled water. The purpose of the tests was to evaluate the removal efficiencies of diclofenac for variable doses of reagents and pH. The interactions of organic compound in the presence of the coagulant combined with the powdered activated carbon would be surface mechanisms (physical adsorption, ligand exchange or complexation on the surface of flocs of aluminum hydroxide or powdered activated carbon). Findings demonstrated that the addition of powdered activated carbon notably improved diclofenac removal, particularly under near-neutral pH conditions.

Keywords: Coagulation-flocculation; aluminium sulphate; powdered activated carbon; non -steroidal anti-inflammatory drugs; mechanisms.

Introduction

Non-steroidal anti-inflammatory drugs (NSAIDs) are a class of pharmaceuticals commonly administered for pain management, fever reduction, and inflammation control. Due to their widespread and prolonged usage, reports of associated adverse effects have significantly increased. Clinical findings associate prolonged NSAID intake with elevated risks of nephrotoxicity, cardiovascular complications, and gastrointestinal disorders (Brune and Patrignani, 2015).

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Their extensive consumption has contributed to growing concern over their environmental persistence and ecotoxicological impact. NSAIDs are characterized by poor biodegradability, chemical stability, and a strong potential for bioaccumulation. These properties contribute to their continued presence in various environmental compartments.

Frequent detection of NSAIDs such as diclofenac, ibuprofen, and naproxen has been documented in surface waters, effluents from wastewater treatment facilities, and occasionally in potable water sources. Empirical data compiled globally indicate that these compounds are among the most recurrent pharmaceutical pollutants in aquatic systems, representing approximately 15% of total pharmaceutical contaminants identified in international water quality surveys.

Concentrations ranging from nanogram to microgram levels per liter have been reported for several NSAIDs, including ketoprofen, mefenamic acid, and diclofenac. These residues are predominantly introduced into the environment through treated wastewater discharges. Detection of NSAIDs has been confirmed in diverse aquatic matrices, including rivers, coastal waters, groundwater, wastewater effluents, and sewage sludge (Lakshmi et al., 2024).

Toxicological studies have established that NSAIDs exert detrimental effects on aquatic organisms. These include impaired reproductive capacity, abnormal growth patterns, and altered behavior in species such as fish, amphibians, and invertebrates (Schwaiger et al., 2004). Phytoplankton exhibit the highest sensitivity, with documented acute toxicity across multiple trophic levels, including marine microbes and benthic invertebrates (Ruiz and Font, 2011).

Bioaccumulation of NSAIDs such as diclofenac and ibuprofen has been observed in the liver, kidney, gill, and muscle tissues of exposed aquatic organisms. Renal histopathology and subcellular damage have been recorded in rainbow trout. Measured environmental concentrations of diclofenac in natural and treated waters have exceeded levels considered critical for aquatic toxicity. Furthermore, degradation products of ibuprofen and naproxen formed through photolytic processes may possess enhanced toxicity compared to their parent compounds (Kümmerer, 2009).

Conventional wastewater treatment technologies often fail to fully eliminate pharmaceutical residues. The removal efficiency of NSAIDs is largely influenced by their interaction with particulate matter, which facilitates their separation through physicochemical approaches like coagulation, sedimentation, and flotation, or through biological degradation pathways (Roberts and Thomas, 2006).

In contrast to surface and wastewater datasets, information on NSAID occurrence in tap and drinking water remains limited, especially within low- and middle-income countries.

In this study, the aim is to evaluate the effectiveness of coagulation-flocculation using aluminum sulfate in combination with powdered activated carbon on simple organic molecules considered to be refractory because they represent an emerging environmental concern. The tests concern pharmaceutical substances (diclofenac). The aim is to optimize the use of the coagulant reagent (aluminum sulfate) in conjunction with the addition of an adsorbent material (powdered activated carbon) to achieve maximum removal of the aforementioned compound.

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MATERIALS AND METHODS

Preparation of reagents

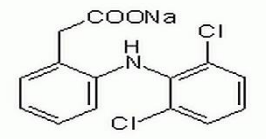
- A stock solution (10 g/L) was prepared by dissolving aluminum sulphate ($Al_2(SO_4)_3,18H_2O$) into distilled water. For this, the stock solution was occasionally changed.
- The powdered activated carbon (PAC) had a particle size of 20 µm and specific surface area equal to 658 m^2/g.

Preparation of diclofenac solutions

Distilled water (pH from 6.07 to 6.79 and conductivity from 2 to 5 µs/cm) .

Diclofenac, at concentrations varying from 2 to 15 mg/L, was added to distilled water. The pH was adjusted as needed by means of 0.1 N HCl and NaOH solutions

Table 1: Main physico-chemical properties of diclofenac sodium (Anses, 2019).

Diclofenac (DFC)	
Chemical formula	
Molecular formula	$C_{14}H_{10}Cl_2NNaO_2$
Molecularweight	318.13 g mol^{-1}
Water solubility	Soluble in water to 50mg/ml.
Log Kow	0.7-1.2
pKa	4.15
log Dow	1.15

Diclofenac analysis

DFC, an aromatic organic compound, was determined using an OPTIZEN 2120 UV UV-visible spectrophotometer equipped with quartz cells and a 1 cm optical path. The wavelength used is 276 nm and corresponds to the maximum absorbance.

The residual concentrations were determined from the absorbance calibration curves (Fig. 2).

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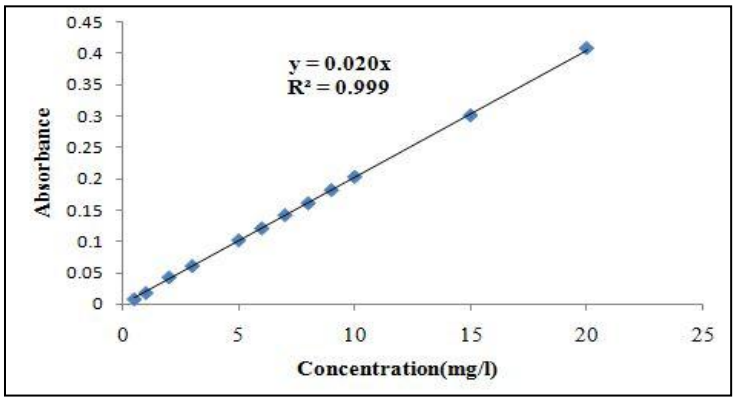

Figure 2: Calibration curves of diclofenac in distilled water(Wave length λ= 276nm)

Description of jar test

The flocculation of diclofenac was carried out in accordance with the jar-test analytical procedure. The equipment used in this test consists of a flocculator with 6 stirrers (Fisher 1198 Flocculator), with a rotational speed that can be varied from 0 to 200 rpm, in order to simulate the dynamics of the coagulation-flocculation process. This apparatus allows for the simultaneous stirring of the solutions contained in a series of 500 ml beakers. Note that each sample was agitated at the speed of 200 rpm for a period of 2 minutes after the addition of the coagulant. Afterwards, the speed was reduced to 60 rpm for a 30 minutes flocculation period. Finally, the flocswere allowed to settle for 30 minutes, before filtration through a 0.45 µm cellulose membrane. The samples were then withdrawn for analysis. In addition, the diclofenac level in the supernatant, after filtration, was monitored by means of the UV absorption test using a UV–Vis spectrophotometer (UV – visible OPTIZEN 2120UV) at 257 nm. A linear correlation was established between the UV reading and the organic compound content, for every type of water.

The removal efficiency of diclofenac was calculated as follows:

$$E\% = \frac{C_0 - C_f}{C_0} \times 100$$

Where C_0 is the initial concentration of the organic compound before adding the coagulant, and C_f is the final concentration of the organic compound after addition of the coagulant.

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RESULTS AND DISCUSSION

Effect of coagulation-flocculation in the presence of aluminum sulfate alone

Prior to testing the dose effect of powdered activated carbon (PAC), synthetic solutions of the organic compounds are prepared at a concentration of 5 mg/l diclofenac in distilled water with pH adjusted to 7. These solutions are jar tested with coagulant alone to obtain the optimum dose of aluminum sulfate. The results obtained are shown in Figure 1.

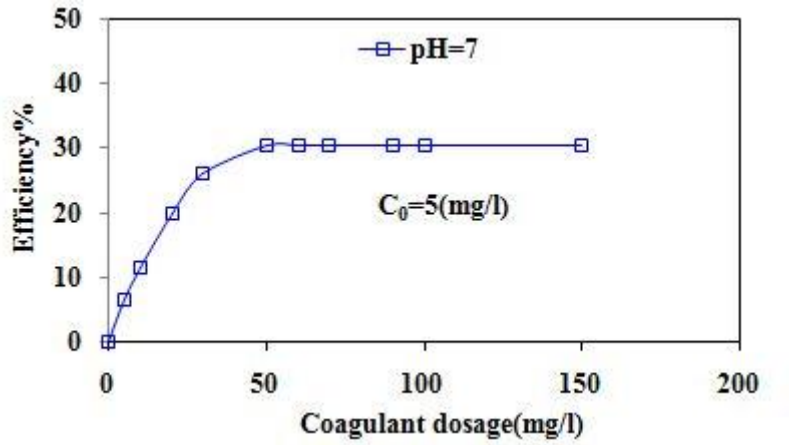

Figure 1: Effect of Aluminum Sulfate Dose on Diclofenac Removal in Distilled Water

[Diclofenac]= 5mg/l ; pH = 7.

Just as has been observed for simple phenolic or carboxylated compounds (Achour and Guesbaya, 2005; Bacha and Achour, 2013), we can observe for diclofenac as well, an increase in elimination yields with the dose of coagulant introduced. However, there is an optimum dose above which yields stabilize. The results in Figure 1 show that the optimum dose of coagulant in distilled water at neutral pH 7 is 50mg/l.

Elimination yields remain fairly average (around 60% at optimum) compared with those obtained by flocculation of humic substances (Bacha and Achour, 2023).

At neutral pH, the removal of these compounds by aluminum sulfate likely occurs through the formation of insoluble salts involving either soluble or insoluble cationic aluminum species monomeric or polymeric in interaction with organic matter. Additional surface-level processes, such as complexation or ligand exchange with hydroxyl groups present on aluminum hydroxide flocs, may also contribute to the elimination mechanism (Bacha and Achour, 2025; Bacha and Achour, 2017).

Effect of aluminum sulfate/activated carbon combination for various CAP dosages

Once the optimum dose of coagulant has been determined, increasing amounts of CAP (0 to 100 mg/l) are combined with this dose of diclofenac. CAP levels are introduced during slow agitation with pH adjustment to 7. The results obtained are shown in Figure 2.

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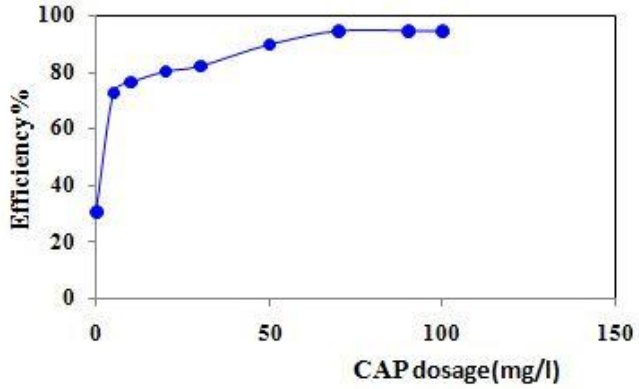

Figure 2: Removal of Diclofenac by Powdered Activated Carbon Combined with the Optimal Dose of Aluminum Sulfate in Distilled Water

[diclofenac] 5mg/l ; pH = 7.

The introduction of powdered activated carbon (PAC), combined with the optimum dose of coagulant (50 mg/l), significantly improves diclofenac removal yields (94.29%). It should also be noted that these efficiencies increase as the added CAP content increases.

The enhanced removal of diclofenac observed with the combined use of aluminum sulfate and PAC is likely due to the adsorption of diclofenac molecules onto the PAC surface. Given the mesoporous structure of the PAC used, the small size of diclofenac molecules may enable their diffusion into the internal pores. Similar performance was previously reported with this PAC in adsorption experiments involving paracetamol in distilled water (Bacha and Achour, 2018).

Table 2 summarizes and compares the removal efficiencies obtained using the coagulant alone and in combination with powdered activated carbon.

Table 2 : Summary of Diclofenac (5 mg/L) Removal Results Using Aluminum Sulfate Alone (AS) and in Combination with PAC (AS + PAC)

	Diclofenac	
	Aluminum sulfate alone	**Aluminum sulfate + CAP**
Optimal coagulant dosage(mg/l)	50	
Optimal CAP dosage(mg/l)		90
Efficiency%	29,52	94,29

According to Yuasa et al., (1997), activated carbon has a higher adsorption coefficient for low molecular weight fractions than for high molecular weight fractions. for low-molecular-weight fractions than for high-molecular-weight fractions. high-molecular-weight fractions. The literature also states that unlike aliphatic organic molecules, aromatic molecules are well molecules are well eliminated by retention on activated carbon (Bacha and Achour, 2018). The

compounds tested would be retained on activated carbon, as for most organic molecules in water, by physical adsorption. physical adsorption.

Indeed, all the studies carried out by Didier (1997) on five different activated carbons led to the conclusion that the mainmain adsorption mechanism for the pollutants studied (phenols and phthalates)is physisorption in the porosity of activated carbons. Similarly, the studyadsorption of organic molecules (phenol, paranitrophenol, benzoic and salicylic acidsbenzoic, salicylic and picric acids) on activated carbons, both raw and treated treatment, indicates that adsorption phenomena are essentially due to Van der Wallsdue to Van der Walls interactions, highlighted by their energetic aspect (Julien et al., 1994).

CONCLUSION

This study aimed to enhance the removal of diclofenac through coagulation-flocculation using aluminum sulfate in combination with powdered activated carbon (PAC).

Experimental results and analysis highlighted the influence of operational parameters, including reagent doses and pH, on removal efficiency. Under neutral pH conditions, diclofenac showed moderate removal by aluminum sulfate, primarily through surface-specific mechanisms involving hydrolyzed aluminum species.

The addition of PAC significantly improved removal efficiency for diclofenac, especially in the pH range of 4 to 7. The low molecular weight and functional groups attached to the aromatic rings of diclofenac may also contribute to their reactivity. The predominant mechanisms appear to involve surface interactions and/or complexation processes.

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ALLERGENS AND THEIR LABELING: A STUDY IN HOTELS IN STRUGA

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Abstract

Food allergies represent an increasingly common health issue worldwide, with potentially serious consequences for affected individuals. To protect consumers, especially those with allergies or intolerances, clear and precise labeling of allergens in food is essential. This study aims to analyze the regulations on allergen labeling in food, as well as their practical implementation in the hotel sector in Struga, the Republic of North Macedonia. The research includes an analysis of five menus from different hotels in Struga, focusing on how guests are informed about potential allergens in food.

The results show that allergens were only partially addressed. In 4 out of 5 menus, a general note was present—usually placed on the first or last page—stating that guests with allergies should consult the waiter. However, only two hotel menus clearly indicated allergens for each individual dish, which serves as a positive example that other hotels could follow. On the other hand, one menu contained no information about allergens, neither through symbols nor textual warnings. This is considered a serious shortcoming in guest information and represents a potential risk to the health of individuals with allergies.

This study highlights the need for greater compliance with European regulations, improved transparency in hospitality establishments, and the introduction of standardized practices for allergen labeling. Such measures contribute to enhancing food safety and consumer protection.

Keywords: allergens, food safety, hospitality, labeling, hotel menus

1. INTRODUCTION

Lawmakers in the United States adopted the Food Allergen Labeling and Consumer Protection Act of 2004 (FALCPA).[1]

On October 25, 2011, with the adoption of Regulation (EU) No. 1169/2011, new rules regarding food labeling were introduced. These rules are described in detail, with most of them coming

[1] **ALLERGENS – DIFFERENCES IN EU/USA LEGAL REGULATIONS, asconsulting.rs, available at:** https://asconsulting.rs/alergeni-razlike-u-zakonskoj-regulativi-eu-usa/ (accessed: 7 July 2023)

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into effect on December 13, 2014 (with the exception of the rules on nutritional labeling, which came into force on December 13, 2016).[2]

As a candidate country for EU membership, the Republic of North Macedonia continuously aligns its legislation with the new rules applied in the European Union. Currently, the Law on Food Safety is in force (Official Gazette of the Republic of Macedonia, No. 157/10, 53/11, 1/12, 164/13, 187/13, 43/14, 72/15, and 209/2023).

Specifically, the Law Amending and Supplementing the Law on Food Safety, published in the Official Gazette of the Republic of Macedonia, No. 72 of May 5, 2015, introduces amendments and supplements to the Law on Food Safety (Official Gazette of the Republic of Macedonia, No. 157/10, 53/11, 1/12, 164/13, 187/13, and 43/14). Among other changes, six new articles—29-a, 29-b, 29-v, 29-g, 29-d, and 29-ѓ—are added after Article 29. These articles establish general rules regarding food information, responsibilities related to food information, mandatory food information, and additional mandatory information, all with the aim of aligning the national legislation with the aforementioned Regulation (EU) No. 1169/2011.

Additionally, a new Rulebook on Food Information was adopted and published in the Official Gazette of the Republic of Macedonia, No. 150 of September 2, 2015. With its entry into force, the Rulebook on the Manner of Food Labeling (Official Gazette No. 118/05) ceased to be valid.

2. GENERAL INFORMATION

The rules apply to food business operators at all stages of the food chain and to all food intended for the final consumer (including food served in catering establishments). The rules pertain to food information with the aim of ensuring a high level of protection for consumer health and interests. Food information must not be misleading.[3]

Food business operators are responsible for the accuracy of the food information. These are the persons responsible for placing the food on the market, or the importer in cases where the food is imported.[4]

Regulation (EU) No. 1169/2011 does not apply to private individuals who prepare and provide food for specific events (such as church, school, or village fairs), unless they are preparing the food in the capacity of food business operators.[5]

3. ALLERGENS

According to the IFS glossary (Annex 12 Glossary, IFS Food Standard Version 7), an allergen is defined as: *"a food that causes an adverse reaction related to the body's immune response."*[6] Allergens are substances that trigger a chemical reaction in the body. Chemically, they are most often proteins, but they can also include polysaccharides (sugars), lipoids (fat-like substances), as well as inorganic substances.[7]
From this, we can answer the question regarding the type of hazard allergens represent: allergens fall under the **chemical hazard** category.

[2] Guidance for Good Practice for Food Business Operators Regarding the New EU Food Labelling Requirements. December, 2014, pp. 4–5 (in the manual: pp. 5–6)
[3] Guidance for Good Practice for Food Business Operators Regarding the New EU Requirements
[4] Ibid.
[5] Ibid.
[6] **FOOD AS AN ALLERGEN (ALLERGEN MANAGEMENT), https://asconsulting.rs/, available at:** https://asconsulting.rs/hrana-kao-alergen/ (accessed: 14 September 2022)
[7] Ibid.

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Allergens can be classified into two types:

- **Nutritional allergens** (from food)
- **Inhalation allergens** (airborne allergens – pollen from various trees such as poplar, birch, willow, hazel; grasses and weeds; dust mites; dust; animal hair and feathers from domestic animals and pets).
Both types can cause allergic reactions.[8]

In most food production lines, more than one product is manufactured, which makes **unintentional cross-contamination with allergens possible**.[9]

Annex 1 of the *Rulebook on Food Information*, published in the *Official Gazette of the Republic of Macedonia, No. 150 of 2.09.2015*, defines a list of **14 substances or products that cause allergies or intolerances**, as follows:

Annex 1: SUBSTANCES OR PRODUCTS CAUSING ALLERGIES OR INTOLERANCES

1. **Cereals containing gluten**, namely: wheat, rye, barley, oats, spelt, kamut or their hybridized strains and products thereof, except:
   - (a) wheat-based glucose syrups including dextrose;
   - (b) wheat-based maltodextrins;
   - (c) barley-based glucose syrups;
   - (d) cereals used for the manufacture of alcoholic distillates including ethyl alcohol of agricultural origin.
2. **Crustaceans and products thereof.**
3. **Eggs and products thereof.**
4. **Fish and products thereof**, except:
   - (a) fish gelatin used as a carrier for vitamins or carotenoid preparations;
   - (b) fish gelatin or isinglass used as a fining agent in beer and wine.
5. **Peanuts and products thereof.**
6. **Soybeans and products thereof**, except:
   - (a) fully refined soybean oil and fat;
   - (b) natural mixed tocopherols (E306), natural D-alpha tocopherol, natural D-alpha tocopherol acetate, and natural D-alpha tocopherol succinate derived from soybeans;
   - (c) vegetable oils derived phytosterols and phytosterol esters from soy;
   - (d) plant stanol esters produced from sterols derived from soybean vegetable oil.
7. **Milk and products thereof (including lactose)**, except:
   - (a) whey used for the manufacture of alcoholic distillates, including ethyl alcohol of agricultural origin;

[8] Ibid.
[9] Allergens. avicena.gov.mk. Available at: https://avicena.com.mk/proizvod/алергени/

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- (b) lactitol.

8. **Nuts**, namely: almonds (*Amygdalus communis L.*), hazelnuts (*Corylus avellana*), walnuts (*Juglans regia*), cashew nuts (*Anacardium occidentale*), pecan nuts (*Carya illinoinensis*), Brazil nuts (*Bertholletia excelsa*), pistachio nuts (*Pistacia vera*), macadamia nuts or Queensland nuts (*Macadamia ternifolia*), and products thereof, except nuts used for the manufacture of alcoholic distillates including ethyl alcohol of agricultural origin.

9. **Celery and products thereof.**

10. **Mustard and products thereof.**

11. **Sesame seeds and products thereof.**

12. **Sulfur dioxide and sulphites** in concentrations exceeding 10 mg/kg or 10 mg/liter in terms of total SO_2 to be calculated for products ready for consumption or reconstituted according to the manufacturer's instructions.

13. **Lupin and products thereof.**

14. **Mollusks and products thereof.**[10]

3.1. Allergens – differences in legislation between the EU and the USA

Food legislation is not uniform across all parts of the world. Therefore, when exporting food products to countries such as the United States or Canada, it is crucial to align product labeling with the **laws and requirements** of the **importing country**.[11]

Given that research shows about **12% of the population suffers from food allergies**, and that this number is increasing, **identifying allergens** in food products and **declaring them correctly** is a top priority. However, legislation and labeling methods **vary between countries**.[12]

EU Legislation

According to **Regulation (EU) No. 1169/2011** of the European Parliament and of the Council, the following foods are designated as allergens responsible for over **90% of allergic reactions**:

- Cereals containing gluten (e.g., wheat, rye, barley, oats, spelt, kamut or their hybridized strains) and products thereof
- Crustaceans and products thereof
- Eggs and egg products
- Fish and fish products
- Peanuts and peanut products
- Soybeans and soybean products
- Milk and dairy products (including lactose)
- Tree nuts, specifically: almonds (*Amygdalus communis L.*), hazelnuts (*Corylus avellana*), walnuts (*Juglans regia*), cashews (*Anacardium occidentale*), pecans (*Carya*

[10] Rulebook on Food Information, published in Official Gazette of the Republic of Macedonia, No. 150 of 2 September 2015, and Guidance for Good Practice for Food Business Operators Regarding the New EU Food Labelling Requirements (mostly applicable from 13 December 2014), prepared by the Food and Veterinary Agency (pp. 44–45)
[11] ALLERGENS – DIFFERENCES IN EU/USA LEGAL REGULATIONS
[12] Ibid.

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illinoinensis), Brazil nuts (*Bertholletia excelsa*), pistachios (*Pistacia vera*), macadamia nuts (*Macadamia ternifolia*)

- Celery and products thereof
- Lupin and products thereof
- Mollusks and products thereof
- Mustard and products thereof
- Sesame seeds and products thereof
- Sulfur dioxide and sulphites in concentrations exceeding 10 mg/kg or 10 mg/l (expressed as SO_2).[13]

Regulation 1169/2011 requires clear labeling of all food additives, processing aids, and other substances or products known to cause allergies or intolerances. This enables consumers—especially those with allergies—to make **safe and informed food choices**.[14]

Allergen labeling in the EU mandates that allergens be **visibly distinguished** from the rest of the ingredient list, often using **bold text, different fonts, or background colors**.[15]

US Legislation

In the United States, although many foods may cause allergic reactions, the **Food Allergen Labeling and Consumer Protection Act (FALCPA) of 2004** identifies **eight "major allergens"**:

1. Milk
2. Eggs
3. Fish
4. Shellfish (e.g., crab, lobster, shrimp)
5. Tree nuts (e.g., almonds, walnuts)
6. Peanuts
7. Wheat
8. Soy[16]

As of **January 1, 2023**, **sesame** has been added as the **ninth major food allergen**.[17]

Note:

- Highly refined oils derived from these foods, and
- Ingredients exempted via petition or notification under FALCPA, are **not required** to be labeled as allergens.[18]

FALCPA mandates that food labels **clearly identify** the **food source** of all ingredients that are or contain proteins from the major allergens. This can be done in **two ways**:

1. **In parentheses** following the name of the ingredient in the ingredients list:

[13] Ibid.
[14] Ibid.
[15] Ibid.
[16] Ibid.
[17] Ibid.
[18] Ibid.

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- e.g., *"lecithin (soy)"*, *"flour (wheat)"*, *"whey (milk)"*

2. **In a "Contains" statement** directly after or next to the ingredients list:
   - e.g., *"Contains: wheat, milk, soy".*[19]

Companies that **export food products** must ensure **compliance with the allergen legislation** of the **importing country**, as **differences in laws** can lead to **mislabeling**, regulatory **non-compliance**, and **health risks** for allergic consumers.[20]

4. POSITIVE LEGAL REGULATIONS GOVERNING RULES ON FOOD INFORMATION WITH AN EMPHASIS ON ALLERGENS IN THE REPUBLIC OF NORTH MACEDONIA

The Law Amending and Supplementing the Law on Food Safety, published in the Official Gazette of the Republic of Macedonia No. 72 on May 5, 2015, amends and supplements the Law on Food Safety (Official Gazette of the Republic of Macedonia No. 157/10, 53/11, 1/12, 164/13, 187/13, and 43/14), whereby six new articles are added after Article 29: Articles 29-a, 29-b, 29-c, 29-d, 29-e, and 29-f.[21]

Article 29-a establishes General Rules on Food Information and reads as follows:

"(1) Food business operators must provide all food information in order to ensure a high level of protection of consumer health and their interests, allowing final consumers to make informed choices based on that information and to use food safely, with particular attention to health, economic, environmental, social, and ethical factors. This information must comply with the food information rules outlined in paragraph (3) of this Article.

(2) The rules on food information aim to enable the free movement of food placed on the market while taking into account the need to protect the interests of producers and promote the production of safe and quality products.

(3) The rules on food information cover:

- General principles for labeling, presentation, and advertising of food,
- General and specific requirements for food labeling, and
- Responsibilities of food business operators regarding the provision of food information.

(4) Food business operators must display food information at all stages of food production, especially in the production chain phases for which they are responsible. This applies to all types of food intended for the final consumer, including food products delivered by and to large suppliers.

(5) Any food intended for delivery to the final consumer or to large food suppliers and catering facilities must be accompanied by appropriate food information in accordance with the regulation from Article 29-d, paragraph (3) of this Law.

(6) A food business operator must not mislead consumers through food information regarding: a) The characteristics of the food, particularly in relation to its nature, identity, properties, composition, quantity, durability, country or place of origin, method of manufacture or

[19] Ibid.
[20] Ibid.
[21] Law on Amendments and Supplements to the Law on Food Safety, published in the Official Gazette of the Republic of Macedonia, No. 72 of 5 May 2015

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production;
b) Attributing effects or properties to the food which it does not possess;
c) Suggesting that the food has special characteristics when, in fact, all similar foods possess such characteristics, especially by emphasizing the presence or absence of certain ingredients and/or nutrients;
d) Through appearance, description, or pictorial representation, implying the presence of a specific food or ingredient, when a naturally occurring component or commonly used ingredient has been replaced by a different component or ingredient.

(7) Food information must be accurate, clear, and easily understood by the consumer.

(8) The provisions of paragraph (6) of this Article also apply to:
a) Advertising, and
b) Presentation of food products, particularly their shape, appearance or packaging, the way packaging materials are used, and the setting in which food products are displayed or sold."[22]

Article 29-b establishes Responsibilities for Food Information and reads as follows:

"(1) Responsibility for food information lies with the food business operator who produces, packages, or imports the food, or the one who places the food on the market and under whose name or business name the food is marketed in the Republic of Macedonia.

(2) The food business operator responsible for the food information ensures the presence and accuracy of the food information.

(3) Food business operators who do not influence the food information must not supply, deliver, provide, use, or sell food which they know or suspect, based on their professional knowledge, does not comply with the specific food safety requirements and food labeling rules.

(4) Food business operators, within the business activities under their control, must not modify labeling information that accompanies the food if such modifications would mislead consumers or otherwise reduce the level of consumer protection and the ability of the final consumer to make informed choices. They are responsible for any changes made to the food information on the label.

(5) Food business operators, within the business activities under their control, must ensure compliance with food labeling rules and specific food safety requirements for different types of food, and in doing so, must verify whether these requirements are fulfilled, taking into account their responsibilities under paragraphs (2), (3), and (4) of this Article.

(6) Food business operators, within the business activities under their control, must ensure that information regarding food that is not pre-packaged but intended for the final consumer or for delivery to large suppliers is passed on to the receiving food business operator, in order to provide, where necessary, mandatory food information to the final consumer.

(7) Food business operators, within the business activities under their control, must ensure that the mandatory and additional mandatory food information related to the specifics of certain types or categories of food products is provided on the packaging label, on a label affixed to the packaging, or in commercial documents relating to the food products, provided these documents either accompany the food to which they refer or are sent before or at the time of delivery, in the following cases:
(a) When pre-packaged food is intended for the final consumer but is marketed at a stage prior to sale to the final consumer, and when the sale to a large supplier is not part of that stage; and

[22] Ibid.

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(b) When pre-packaged food is intended for delivery to large suppliers for preparation, processing, splitting, or cutting.

(8) Food business operators are obliged to ensure that mandatory information, such as the name of the food, the minimum durability date or "use by" date, any special storage conditions and/or conditions of use, and the name or business name and address of the food business operator referred to in Article 29-d, paragraph (1), items (a), (e), (g), and (h) of this Law, is indicated on the external packaging in which the food products are prepared for market placement.

(9) Food business operators who deliver food to other food business operators that is not intended for the final consumer or large suppliers must ensure that the receiving operators are provided with sufficient information to enable them to fulfill their obligations under paragraph (2) of this Article."[23]

Article 29-v establishes Food Information, whereby, among other things, in paragraph (1), indent 5 of the same Article, it is determined that each food shall be labeled, among other food information, with substances or products causing allergies or intolerances. The aforementioned Article 29-v of the Law on Food Safety reads in full as follows:

"(1) Each food shall be labeled with the following food information:

- mandatory food information;
- additional mandatory food information related to the specific characteristics of certain types or categories of food products;
- voluntary food information, additional forms of expression and presentation of the food;
- the manner of food labeling, detailed provisions for mandatory labeling and exemptions from mandatory labeling;
- substances or products causing allergies or intolerances;
- food products for which the labeling must include one or more additional characteristics;
- food products exempt from the requirement for a mandatory nutrition declaration;
- name of the food and specific accompanying characteristics and mandatory particulars alongside the name of the food;
- specific requirements regarding the labeling of "minced meat";
- specific requirements regarding the labeling of casings for sausages and indication of ingredients;
- special provisions regarding the labeling of ingredients in descending order by weight;
- indication of certain ingredients by category name rather than specific name;
- labeling of additives by their category name followed by their specific name or E-number;
- labeling of flavorings in the list of ingredients;

[23] Ibid.

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- labeling of compound ingredients;
- quantitative indication of ingredients;
- labeling of net quantity;
- expiration date, “use by” date, and date of freezing;
- labeling of types of meat for which country of origin or place of provenance is mandatory;
- labeling of alcoholic strength;
- recommended daily reference intakes for vitamins and minerals;
- reference intakes for energy and specified nutrients, excluding vitamins and minerals;
- labeling of conversion factors, conversion factors for calculating energy;
- expression and presentation of nutrition labeling; and
- the manner of presenting voluntary food information.

(2) Mandatory food information includes information that falls within one of the following categories:
(a) regarding the identity and composition, properties, or other characteristics of the food;
(b) regarding the protection of consumer health and safe use of food, which especially includes:

- compositional properties that may be harmful to the health of specific groups of consumers;
- durability, storage, and safe usage; and
- the impact on health, including risks and consequences related to harmful and hazardous consumption of food; and

(c) regarding nutritional characteristics to enable consumers to make appropriate choices based on this information, thereby providing an opportunity for choice for consumers with special dietary requirements.”[24]

Article 29-g establishes Mandatory Food Information, whereby, in paragraph (1), item (c), it is determined that the food business operator is obliged to indicate on the food label, in addition to other mandatory food information, any ingredient or processing aid that causes allergies or intolerances and that is used in the manufacture or preparation of the food and is still present in the final product, even in an altered form. The aforementioned Article 29-g of the Law on Food Safety reads in full as follows:

“(1) The food business operator shall indicate the following mandatory food information on the food label:
(a) the name of the food;
(b) the list of ingredients;
(c) any ingredient or processing aid that causes allergies or intolerances and that is used in the manufacture or preparation of the food and is still present in the final product, even in an altered form;
(d) the quantity of certain ingredients or categories of ingredients;
(e) the net quantity of the food;
(f) the date of minimum durability or the “use by” date;

[24] Ibid.

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(g) special storage conditions and/or conditions of use;
(h) the name or business name and address of the food business operator;
(i) the country of origin or place of provenance;
(j) instructions for use when necessary to ensure proper use of the food;
(k) in the case of beverages containing more than 1.2% alcohol by volume, the actual alcoholic strength by volume shall be indicated; and
(l) nutrition information of the food.

(2) The information in paragraph (1) of this Article shall be presented in words and numbers. It may additionally be expressed through pictograms or symbols.

(3) The Director of the Agency shall prescribe the food information, the procedure for approving pictograms or symbols as a means of expressing food information, the required documentation, and the amount of the costs in the procedure for issuing the approval, upon prior consent of the Government of the Republic of Macedonia."[25]

Pursuant to Article 10 of the Law Amending and Supplementing the Law on Food Safety published in the Official Gazette of the Republic of North Macedonia No. 209/23 of 05 October 2023, amending the Law on Food Safety (Official Gazette of the Republic of Macedonia Nos. 157/10, 53/11, 1/12, 164/13, 187/13, 43/14, 72/15, 84/15, 213/15, 39/16, 64/18), in the above-mentioned Article 29-g, paragraph (3), the words: "upon prior consent of the Government of the Republic of Macedonia" shall be deleted.[26]

Article 29-d establishes Additional Mandatory Information and reads as follows:

"(1) In addition to the mandatory information, the Agency, in the regulations on specific food safety requirements for particular types or categories of food from Article 27 paragraph (11) of this Law, shall prescribe additional mandatory information due to the specificities and characteristics of particular types or categories of food products.
(2) Additional mandatory information is intended to provide the consumer with information regarding the particular types or categories of food products, taking into account technical progress, scientific developments, the protection of consumers' health, and the safe use of food."[27]

Article 29-gj reads as follows:

"(1) Mandatory food information must be accessible and easily readable.
(2) In the case of pre-packaged food or food in its original packaging, the mandatory information must appear directly on the packaging.
(3) The Director of the Agency shall prescribe the food information that must appear on the food labeling, upon prior consent of the Government of the Republic of Macedonia."[28]

Considering the above stated in Articles 29-v and 29-g of the Law on Food Safety (Official Gazette of the Republic of Macedonia, No. 157/10, 53/11, 1/12, 164/13, 187/13, 43/14, 72/15, 84/15, 213/15, 39/16, 64/18, and Official Gazette of the Republic of North Macedonia No. 209/23),
it can be concluded that **allergens fall under the category of Mandatory Food Information**, within the types of information concerning:
the protection of consumers' health and the safe use of food, particularly including:

[25] Ibid.
[26] Official Gazette of the Republic of Macedonia," No. 209 of 5 October 2023, p. 2
[27] Law on Amendments and Supplements to the Law on Food Safety, published in the Official Gazette of the Republic of Macedonia, No. 72 of 5 May 2015
[28] Ibid.

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- **composition properties that may be harmful to the health of certain groups of consumers.**

Pursuant to Article 97 of the Law Amending and Supplementing the Law on Food Safety, published in the **Official Gazette of the Republic of North Macedonia No. 209/23 dated October 5, 2023**, which amends the Law on Food Safety (Official Gazette of the Republic of Macedonia No. 157/10, 53/11, 1/12, 164/13, 187/13, 43/14, 72/15, 84/15, 213/15, 39/16, 64/18),
Article 133 is amended, and among other things, in paragraph 1 point 9, it is stipulated that:

A fine shall be imposed in the amount of:

- **from 300 to 600 euros in denar countervalue for micro traders,**
- **from 600 to 1,000 euros for small traders,**
- **from 1,000 to 2,000 euros for medium traders,**
- **from 3,000 to 6,000 euros for large traders,**

for a misdemeanor committed by a legal entity if:
9) the food labeling does not include the mandatory food information (Article 29-g paragraph (1)).

Moreover, the **above-mentioned Law Amending and Supplementing the Law on Food Safety**, published in the **Official Gazette No. 209/23 dated October 5, 2023**, ensures alignment with **Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017** on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products, **amending Regulations (EC) No. 999/2001, (EC) No. 396/2005, (EC) No. 1069/2009, (EC) No. 1107/2009, (EU) No. 1151/2012, (EU) No. 652/2014, (EU) 2016/429 and (EU) 2016/2031 of the European Parliament and of the Council, Regulations (EC) No. 1/2005 and (EC) No. 1099/2009 and Directives 98/58/EC, 1999/74/EC, 2007/43/EC, 2008/119/EC and 2008/120/EC and repealing Regulations (EC) No. 854/2004 and (EC) No. 882/2004 of the European Parliament and of the Council, Council Directives 89/608/EEC, 89/662/EEC, 90/425/EEC, 91/496/EEC, 96/23/EC, 96/93/EC and 97/78/EC and Council Decision 92/438/EEC** (CELEX number **32017R0625**).[29]

Based on Article 29-g paragraph (3) of the Law on Food Safety ("Official Gazette of the Republic of Macedonia" no. 157/10, 53/11, 1/12, 164/13, 187/13, 43/14, and 72/15), the Director of the Food and Veterinary Agency enacted the RULEBOOK ON FOOD INFORMATION published in the "Official Gazette of the Republic of Macedonia", no. 150 dated 2.09.2015.[30]

This Rulebook aligns with **Regulation (EU) No 1169/2011** of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers, amending Regulations (EC) No 1924/2006 and (EC) No 1925/2006 of the European Parliament and of the Council, and repealing Commission Directive 87/250/EEC, Council Directive 90/496/EEC, Commission Directive 1999/10/EC, Directive 2000/13/EC of the European Parliament and of the Council, Commission Directives 2002/67/EC and 2008/5/EC and Commission Regulation (EC) No 608/2004, CELEX 32011R1169.[31]

[29] "Official Gazette of the Republic of Macedonia," No. 209 of 5 October 2023, p. 2
[30] "Official Gazette of the Republic of Macedonia," No. 150 of 2 September 2015, p. 37
[31] Rulebook on Food Information, published in the Official Gazette of the Republic of Macedonia, No. 150 of 2 September 2015

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In the aforementioned Rulebook, in **CHAPTER 3, titled MANDATORY FOOD INFORMATION, Section 1**, Article 5 paragraph 1 determines the basic data and food information that are mandatory according to Article 29-g of the Law on Food Safety, including:

Point 3: Any ingredient or processing aid or other substance that causes allergies or intolerances and is listed in **Annex 1**, which is an integral part of this Rulebook, and is used in the manufacture or preparation of food and is still present in the final product, even in an altered form, must be emphasized and clearly distinguished from other ingredients in the ingredients list.[32]

Article 5 of the above-mentioned Rulebook is identical to **Article 29-g** of the Law on Food Safety.

Furthermore, in **CHAPTER 3, titled MANDATORY FOOD INFORMATION, Section 2 – titled Detailed Provisions on Mandatory Information**, **Article 15** sets the requirements that ingredients causing allergies or intolerances from Article 5 paragraph 1 point 3 must fulfill.

Article 15 of the above-mentioned Rulebook reads in full:

(1) Ingredients that cause allergies or intolerances from Article 5 paragraph (1) point (3) of this Rulebook must meet the following requirements:

1. Substances or products causing allergies or intolerances shall be indicated in the list of ingredients in accordance with the rules established in Article 12 paragraph (1) of this Rulebook, clearly referring to the name of the substance or product as listed in **Annex 1** of this Rulebook; and

2. The name of the substance or product listed in **Annex 1** must be clearly emphasized using different font styles, formats, or font and background colors so that it is clearly distinguishable from the list of ingredients.[33]

In the absence of a list of ingredients, the indication of substances or products causing allergies or intolerances shall include the word "contains" followed by the name of the substance or product.

When several ingredients or processing aids in food are derived from substances or products that cause allergies or intolerances, each such ingredient or processing aid shall be clearly stated on the label.

The indication of ingredients that cause allergies or intolerances from Article 5 paragraph (1) point (3) of this Rulebook is not required in cases where the name of the food clearly refers to the substance or affected product.

(2) The provisions for ingredients causing allergies or intolerances from paragraph (1) of this Article also apply to food in **catering establishments and self-service food**.

According to **Article 30 paragraph 1 point 3** of the **RULEBOOK ON FOOD INFORMATION** published in the "Official Gazette of RM", no.150 of 2.09.2015, allergens are determined as mandatory information for **non-prepacked food**, and under paragraph 2 point 3 of the same Article, allergens are determined as mandatory food information in **catering establishments**, and must be indicated on the menu or at the food display point (in case of self-service). The Article reads:

(1) Mandatory information for food that is not prepacked includes the following:

[32] Rulebook on Food Information, published in the Official Gazette of the Republic of Macedonia, No. 150 of 2 September 2015
[33] Ibid.

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1. the name of the food;
2. the list of ingredients;
3. any ingredient or processing aid or other substance that causes allergies or intolerances and is listed in **Annex 1**, which is an integral part of this Rulebook, and is used in the manufacture or preparation of the food and is still present in the final product, even in an altered form, must be emphasized and clearly distinguished from other ingredients in the list of ingredients;
4. the net quantity of the food; and
5. the date of minimum durability or the "use by" date.

(2) Mandatory food information in **catering establishments** must be indicated in the menu or at the point of display of the food (in case of self-service), and includes:

1. the name of the food;
2. the list of ingredients; and
3. any ingredient or processing aid or other substance that causes allergies or intolerances and is listed in **Annex 1**, which is an integral part of this Rulebook, and is used in the manufacture or preparation of the food and is still present in the final product, even in an altered form, must be emphasized and clearly distinguished from other ingredients in the list of ingredients.[34]

In **Annex 1** of the **RULEBOOK ON FOOD INFORMATION** published in the "Official Gazette of RM", no.150 of 2.09.2015, a list of **14 substances or products** that cause allergies or intolerances is defined. These substances are listed above in the section on allergens.[35]

5. MANDATORY FOOD INFORMATION – PRESENTATION AND LABELLING OF ALLERGENS ON THE MENU

5.1. Mandatory food information

As previously mentioned, the mandatory food information is determined by Article 29-g of the Law on Food Safety ("Official Gazette of the Republic of Macedonia" No. 157/10, 53/11, 1/12, 164/13, 187/13, 43/14, and 72/15). These requirements are also defined by Article 5 of the Rulebook on Food Information ("Official Gazette of the Republic of Macedonia" No. 150 dated 2.09.2015).

5.2. Presentation of mandatory food information

Since mid-May 2016, new regulations also apply to pre-packaged food being sold. The Food Agency has specified that the following information must be indicated using words and numbers: the name of the food, a list of ingredients, any ingredient that may cause an allergic reaction in people (highlighted in bold), quantity of ingredients, net quantity of food, expiration date, special storage conditions, name and address of the food business operator, country of origin, and instructions for use.[36]

The minimum font size must be 1.2 millimeters to ensure visibility for consumers seeking information about the product they intend to purchase. The alcohol content by volume must

[34] Rulebook on Food Information, published in the Official Gazette of the Republic of Macedonia, No. 150 of 2 September 2015
[35] Rulebook on Food Information, published in the Official Gazette of the Republic of Macedonia, No. 150, dated 2 September 2015
[36] New Rules: Cafe Owners Must Declare If Food Contains Allergens, skopjeinfo.mk, available at: https://skopjeinfo.mk/novi-pravila-kafeandzhiite-kje-mora-da-kazhuvaat-dali-hranata-ima-alergeni (accessed: 29 March 2016)

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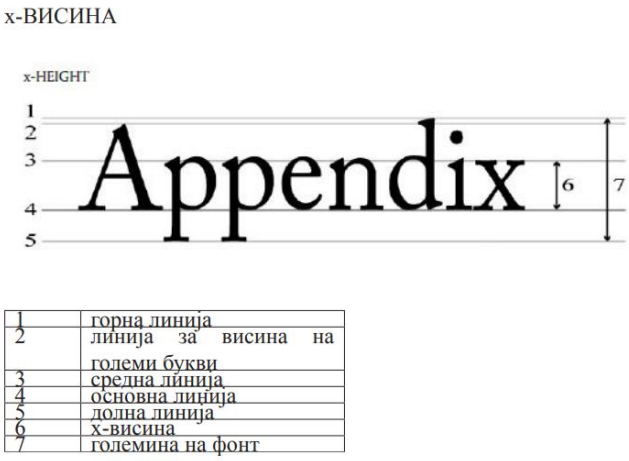
also be indicated (if it contains more than 1.2% alcohol). As of December 13, 2016, the nutritional properties of the food must also be labeled.[37]

For Pre-packaged Food:

- On the packaging or on the label (labels must not be easily removable; the competent authority must individually assess the practicality of self-adhesive labels);
- In addition to words and numbers, pictograms and symbols may also be used;
- Easily visible and placed in a clearly visible location (mandatory food information must not be hidden);
- Indelible (cannot be erased or removed);
- Clearly legible: font size of at least 1.2 mm, or larger (or at least 0.9 mm if the largest surface area of the packaging is less than 80 cm²). When measuring the font size, the x-height of the font is used. The table below illustrates how the x-height of the selected font is measured.



1	горна линија
2	линија за висина на големи букви
3	средна линија
4	основна линија
5	долна линија
6	x-висина
7	големина на фонт

Figure 1. How the x-height of the selected font is measured.

- The name, net quantity, and alcoholic strength must be indicated in the same field of vision (this does not apply to glass bottles intended for reuse and to containers with a largest surface area of less than 10 cm²). "Field of vision" refers to the entire surface of the packaging that can be read from a single viewing angle.[38]

For Food That Is Not Pre-packaged:

- It is mandatory to provide information about substances that cause allergic reactions (this is a legal requirement and it is not sufficient to provide such information only upon the consumer's request. This requirement applies to food sold in restaurants, pubs, and cafés. The information may be presented on menus, boards, signs, or verbally communicated by the establishment's staff. In the latter case, it must be clearly stated that allergen information can be obtained by asking a staff member—this must be indicated on a notice board, menu, sign, or other easily visible label for customers. This requirement also applies to pre-packaged food intended for direct sale, such as in delicatessens, bakeries, sandwich bars, takeaway food outlets, childcare facilities,

[37] New Rules: Café Owners Must Declare Whether Food Contains Allergens
[38] Guidance for Good Practice for Food Business Operators Regarding the New EU Food Labelling Requirements, December 2014, pages 4–5 (in the manual: pages 5–6)

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healthcare institutions, detention centers, delivery services, and charitable organizations where food is provided for free).

- No other information is required (unless the competent authority has established national rules—see the section on "National Measures," point four). Example: For non-pre-packaged food, it is not necessary to indicate the date of freezing (e.g., for frozen meat, frozen meat products, or frozen unprocessed fishery products). This applies to EU member states. According to national regulations in Macedonia, however, the date of freezing must be indicated.[39]

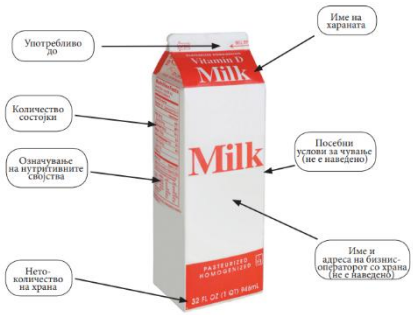

Figure 2. Example of Labelling

5.3. Labelling of allergens on the menu

Catering establishments are required to indicate in their menus whether the food they sell and serve contains allergens. It is mandatory to provide information about substances that cause allergic reactions.

This applies to food sold in restaurants, pubs, and cafés. The information may be presented on the menu, on boards, on cards, or verbally communicated by the establishment's staff. [40]

Caterers should choose their own method for informing consumers about allergens in food. They may list the allergens directly in the menu or on a board.

Alternatively, they may include a message or place a notice on a board reminding customers to ask whether allergens are present and which ones, after which the staff will provide an answer. However, in such cases, the staff must be properly trained to be able to explain this information accurately.[41]

6. MORE DETAILED INFORMATION ON ALLERGENS AS MANDATORY FOOD INFORMATION

Regulation (EU) No. 1169/2011 retains elements from previous legislation and introduces new ones, including the following:

- Highlighting allergens, for example: peanuts or milk, in the list of ingredients.

[39] Guidance for Good Practice for Food Business Operators Regarding the New EU Food Labelling Requirements, December 2014, pages 7–8 (in the manual: pages 8–9)
[40] New Rules: Café Owners Must Record Allergens in the Menu, skopjeinfo.mk, available at: https://skopjeinfo.mk/novi-pravila-kafeandzhiite-kje-mora-da-gi-zapishat-alergenite-vo-meni (accessed: 22 March 2016)
[41] New Rules: Café Owners Must Record Allergens in the Menu, skopjeinfo.mk

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- Substances that cause allergic reactions must be indicated not only for pre-packaged food but also for non-pre-packaged food, including food sold in restaurants, cafés, bed-and-breakfasts, catering vans, etc. (As mentioned earlier, a list of allergens or substances causing intolerance is available and aligned with the EU list).
- Improved readability, i.e., a minimum text size or emphasis (in the case of allergens).[42]

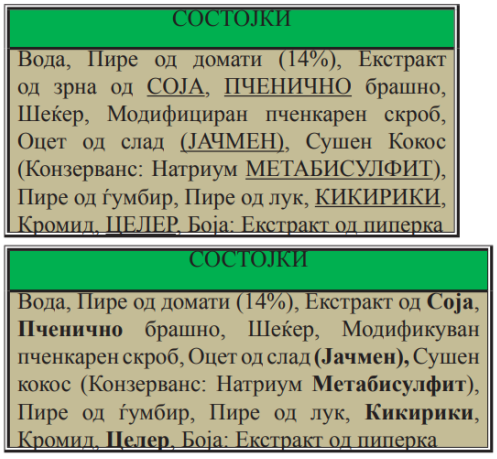
6.1. Allergen Labelling

There is a list of 14 substances that cause allergic reactions or intolerances. This requirement applies not only to food but also to sauces, spices, and beverages (such as wine, juices, cocktails, and smoothies).

If such a substance is present in the food, it must be listed in the ingredients in a way that clearly distinguishes it from the other ingredients on the list.The list of substances that cause allergies and intolerances is available in Regulation (EU) No. 1169/2011. [43]

The same list of substances that cause allergies and intolerances is harmonized in our legislation through the **RULEBOOK ON FOOD-RELATED INFORMATION**, published in the Official Gazette of the Republic of Macedonia, No. 150 dated 2.09.2015, listed in Annex 1 of the rulebook, and these have already been provided above in the section on Allergens.

Example: milk powder (or **milchpulver**, or **poudre de lait**, or **latte in polvere**), where the allergenic ingredient is highlighted in bold. Below are examples of how allergens can be emphasized in the list of ingredients.[44]


СОСТОЈКИ

Вода, Пире од домати (14%), Екстракт од зрна од СОЈА, ПЧЕНИЧНО брашно, Шеќер, Модифициран пченкарен скроб, Оцет од слад (ЈАЧМЕН), Сушен Кокос (Конзерванс: Натриум МЕТАБИСУЛФИТ), Пире од ѓумбир, Пире од лук, КИКИРИКИ, Кромид, ЦЕЛЕР, Боја: Екстракт од пиперка

СОСТОЈКИ

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Figure 3. Example of Allergen Labelling

If the allergen is not obvious from the name of the ingredient, there must be a clear indication of the allergen's name.
Examples: casein should be listed as "casein (milk)", tofu as "tofu (soy)", and sesame oil as "sesame oil (sesame)".

[42] Guidance for Good Practice for Food Business Operators Regarding the New EU Food Labelling Requirements, (mostly applicable from 13 December 2014), Prepared by the Food and Veterinary Agency (pp. 32–33)
[43] Ibid.
[44] Guidance for Good Practice for Food Business Operators Regarding the New EU Food Labelling Requirements, December 2014, (mostly applicable from 13 December 2014), Prepared by the Food and Veterinary Agency, pages 15–20

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In the case of food for which a list of ingredients is not required but that contains substances causing allergic reactions, the allergens must still be indicated (allergen information must be specific to the food, complete, and accurate).

Allergen indication is not necessary when the name of the food clearly refers to the relevant substance.[45]

Example: peanut butter, milk, butter, soy flour.[46]

However, caution is needed because the names of food products may identify one or more allergens contained in a particular food item, but not all of them. For example, egg mayonnaise contains eggs, so there is no need to separately label the eggs. However, other allergens, such as mustard, may also be present and must be labeled separately.[47]

6.2. Exceptions to Allergen Labelling

The European Food Information Council requires that the presence of allergens be indicated in the final food products. However, some ingredients derived from foods listed in Annex II will not cause allergic reactions because they are highly processed (for example, fully refined soybean oil or wheat glucose syrups). This is because the allergen/protein is removed, and the product has been assessed by the European Food Safety Authority (EFSA) as not posing a risk of allergic reaction to consumers.

Substances derived from an allergenic ingredient, which are specifically exempted from labelling according to Annex II (for example: wheat glucose syrup), do not need to be labelled. In the case of wine or wine fining agents obtained from eggs or milk, Regulation (EU) No 579/2012 must be taken into account. When determining whether egg- or milk-based fining agents are still present in the wine, they should not be found at the detection limit (<0.25 mg per liter), as specified in Regulation (EU) No 579/2012. When egg or milk fining agents are not detected at these levels, they are exempt from allergen labelling requirements.[48]

6.3. Labelling of Certain Substances or Products Causing Intolerances

Cereals containing gluten must be listed in the ingredients using the specific name of the cereal, i.e., wheat (including spelt and Khorasan), rye, barley, or oats. Where “spelt,” “Khorasan,” and “kamut” are used, a specific reference to wheat must be provided, for example, “spelt (wheat),” “Khorasan (wheat),” and “kamut (wheat).”

Voluntary inclusion of gluten in the list of ingredients after the mandatory labelling of the cereal containing gluten is possible. However, according to the Regulation, the cereal must be emphasized, not the gluten; for example, “barley (gluten).”

Where food is voluntarily labelled as “gluten-free,” it must comply with the requirements of Commission Regulation No. 41/2009 concerning the composition and labelling of food suitable for people with gluten intolerance.

Ingredients that are or have been derived from cereals containing gluten must be highlighted in the list of ingredients. This clearly indicates to people allergic to specific cereals to avoid such food; for example: “barley malt extract.”

[45] Guidance for Good Practice for Food Business Operators
[46] Ibid.
[47] Ibid.
[48] Ibid.

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Mandatory information about the presence of substances listed in Annex II that cause allergies must, as previously mentioned, be emphasized against other ingredients in the list by using a different font, size, style, or background color.

The Food Safety Authority (БОХ) may use an allergy advice statement on the product label to explain how allergens are highlighted within the list of allergens. [49]

Example:

"Allergy advice: for allergens, see ingredients in bold font" or "Allergy advice: for allergens, including cereals containing gluten, see ingredients marked in blue".[50]

7. RESEARCH IN HOTELS IN STRUGA

7.1. Objective and Methods

The aim of this research is to determine the current state regarding the availability and accuracy of allergen information in the menus of hotel restaurants in the city of Struga. Additionally, the study aims to identify potential opportunities for improving the food offer in order to increase the safety and satisfaction of guests, especially those with specific health needs.

The research was conducted during April 2025. Five hotels were included in the study: Hotel Izgrev, Hotel Mirage, Hotel Freya, Hotel Dishli, and Hotel Drim. The research methodology included direct observation and analysis of the current à la carte menus, as well as informal, semi-structured interviews with waiters present during the field visit. All participating waiters voluntarily agreed to take part and were informed about the purpose of the research, with all data recorded anonymously.

Due to the limited sample size and focus only on a few hotel establishments, additional research should be conducted in other hospitality facilities in the Struga region (restaurants, cafés, guesthouses, etc.) to obtain a complete picture of the situation in the city's overall hospitality offer.

7.2. Main Research Question

Q1. Are nutritional values and allergens indicated in the menus?

Nutritional values were not indicated in any of the analyzed menus. This presents a serious challenge, especially for guests with chronic health conditions such as diabetes. The absence of information on calories, carbohydrates, fats, and proteins limits the ability to make informed food choices and may increase health risks for these individuals.

Allergens were partially addressed. In 4 out of 5 menus, there was a general note, usually placed on the first or last page, stating that guests with allergies should consult the waiter. Only two of the hotel menus clearly listed allergens for each individual dish. This is a positive example that could be followed by the other hotels. In one out of the five menus, allergens were not indicated in any form, which represents a serious shortcoming in guest information and a potentially risky factor for people with allergies, as they cannot identify which dishes are safe for them to consume in a timely manner. This directly affects their health and well-being.

7.3. Recommendations

Based on the obtained results, the following measures are recommended for improvement:

- **Introduction of nutritional information:** Hotels should provide detailed nutritional information for each dish on the menu. This information should include calorie count, and the amount of carbohydrates, fats, proteins, and other relevant data,

[49] Ibid.
[50] Ibid.

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enabling informed and healthy choices for all guests, especially for those with special dietary needs.

- **Clear and systematic allergen labeling:** Each dish on the menu should be accompanied by textual indicators highlighting the presence of potential allergens (e.g., nuts, seafood, eggs, soy, etc.). This approach increases transparency and reduces the likelihood of adverse reactions in allergic individuals.
- **Creation of specialized menus:** It is recommended that hotels develop specialized sections in their menus for guests with specific health needs. These menus may include sugar-free meals, meals with a low glycemic index, gluten-free, lactose-free, or vegan/vegetarian options.
- **Continuous staff education:** Staff, especially waiters and chefs, should regularly attend training on nutrition and allergy management. This will improve their readiness to communicate with guests who have health restrictions.
- **Following global food trends:** Hotels should aim to modernize their food offer by introducing healthy alternatives such as organic products, sugar-free, lactose-free or caffeine-free beverages, as well as meals tailored to special diets (e.g., keto, vegan, gluten-free, etc.).

By implementing these recommendations, hotels in Struga will contribute to creating a more inclusive, safe, and health-oriented hospitality offer. In addition to improving the experience of current guests, such steps could attract new categories of tourists, especially those who care about their health or have specific dietary requirements. In this way, hotels would not only enhance the quality of their service but also increase their contribution to the overall health of tourists and the promotion of healthy lifestyle habits.

8. CONCLUSION

On October 25, 2011, with the adoption of Regulation (EU) No. 1169/2011, new rules regarding food labeling were established. These rules are described in detail, and most of them came into effect on December 13, 2014 (with the exception of the nutrition labeling rules, which began to apply on December 13, 2016). Regulation (EU) No. 1169/2011 retained the previous elements of existing legislation while introducing new ones, including:

- Emphasizing allergenic ingredients, such as peanuts or milk, within the list of ingredients.
- Allergenic substances must be labeled not only on prepacked food (as was previously required), but also on non-prepacked food, including food sold in restaurants, cafés, bed and breakfast establishments, catering vans, etc.
- Improved legibility, such as a minimum font size or highlighting (in the case of allergens).

The Republic of North Macedonia, formerly the Republic of Macedonia, is a candidate country for EU membership and is in a continuous process of harmonizing its legislation with that of the EU. With the adoption of the **Law on Amending and Supplementing the Law on Food Safety**, published in the Official Gazette of the Republic of Macedonia No. 72 from May 5, 2015, amendments were made to the **Law on Food Safety** (Official Gazette No. 157/10, 53/11, 1/12, 164/13, 187/13, and 43/14). Among the changes, six new articles were added after Article 29—namely, Articles 29-a, 29-b, 29-v, 29-g, 29-d, and 29-ѓ—establishing general rules on food information, responsibilities related to food information, mandatory and additional food

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information, all with the aim of aligning national legislation with Regulation (EU) No. 1169/2011. A new **Rulebook on Food Information** was also adopted (Official Gazette of RM, No. 150 from September 2, 2015).

In view of the cited legal provisions, especially Articles 29-v and 29-g of the **Law on Food Safety** (Official Gazette of the Republic of Macedonia Nos. 157/10, 53/11, 1/12, 164/13, 187/13, 43/14, 72/15, 84/15, 213/15, 39/16, 64/18 and Official Gazette of the Republic of North Macedonia No. 209/23), we conclude that **allergens fall under mandatory food information**, particularly in the category of information aimed at protecting consumer health and the safe use of food, which specifically includes:

- properties of the composition that may be harmful to the health of certain consumer groups.

There is a list of **14 substances that cause allergic reactions or intolerances**, available in **Regulation (EU) No. 1169/2011**. This same list is harmonized in our national legislation through the **Rulebook on Food Information** (Official Gazette of RM, No. 150 from September 2, 2015), detailed in Annex 1 of the Rulebook, and already mentioned in the section on allergens.

Allergens are part of the mandatory food information and must be indicated in both words and numbers. This requirement applies to food, sauces, spices, and beverages (such as wine, juices, cocktails, and smoothies). If such a substance is present in food, it must be listed in the ingredients in a way that clearly distinguishes it from the rest. The name of the substance or product, as listed in Annex 1 of the Rulebook on Food Information, must be **clearly highlighted** through a different font type, format, size, or background color so that it is easily distinguishable from the list of ingredients.

In the absence of an ingredient list, the mention of allergenic substances or products must include the word **"contains"**, followed by the name of the substance or product.

If several ingredients or processing aids in the food originate from allergenic substances or products, each ingredient or processing aid must be clearly specified in the labeling.

For **non-prepacked food**, it is mandatory to provide information about allergenic substances. This is a mandatory requirement and it is not sufficient to provide the information only upon consumer request. This requirement applies to food sold in restaurants, pubs, and cafés; the information can be provided on menus, boards, cards, or verbally by the staff. In the latter case, there must be a clearly visible notice on a board, menu, or label informing customers that they can request allergen information from staff. This requirement also applies to prepacked food intended for direct sale, such as in delicatessens, bakeries, sandwich bars, takeaway outlets, childcare facilities, and healthcare institutions, as well as detention centers.

Caterers must independently choose the method by which they inform consumers about allergens. They can include allergen information in the menu or on a board. They may also display a notice reminding consumers to ask about allergens, after which the staff can provide information. In such cases, however, the staff must be properly trained to provide explanations.

The research conducted in hotels in Struga reveals that although there is basic awareness of the importance of informing guests about the presence of allergens, the implementation of this information is still insufficient and inconsistent. The lack of precise and clearly stated allergen information, as well as the complete absence of nutritional values on menus, poses a significant challenge for guests with specific health needs. This not only reduces their satisfaction but can also directly impact their safety and health.

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The recommendations proposed in this paper represent realistic and applicable steps that, if adopted, would significantly improve the gastronomic offering in Struga hotels. By introducing systematic allergen and nutritional information, creating specialized menus, and continuously educating staff, hotels could create a safer and more inclusive environment for their guests.

In a broader context, this approach would contribute to raising the general level of service and enhancing the image of Struga as a tourist destination that follows modern standards and dietary trends, thereby improving the city's competitiveness at both national and international levels.

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COVID-19: REPOSITIONING NIGERIA'S ECONOMY FOR THE NOW AND THE TOMORROW

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Abstract

The failure of past and present administrations to diversify Nigeria's economy evident in the dependence on oil exploration and export is one among the factors responsible for the economic challenges affecting the country. The economic situation of Nigeria has since worsened at the instance of the outbreak of the coronavirus and its attendant ramifications on international trade; manifest in the fall price of crude oil, low foreign and domestic investments, heightened level of unemployment and poverty etc. Interestingly, the agricultural and information communication technology (ICT) sectors have since the outbreak of the coronavirus pandemic proven to be among the thriving sectors in Nigeria despite the seeming neglect of the sectors by the government. This paper examines the extent to which the potentials in the agricultural and information communication technology (ICT) sectors may be utilized to drive sustainable development in Nigeria, Post COVID-19. The study adopts qualitative data method. Purposively selected respondents with expertise on the subject were interviewed. They include economists, agricultural-economists, farmers, software consultants and developers, personnel of Lagos Chamber of Commerce and Industry and Nigerian National Petroleum Corporation (NNPC). Further, the study adopted comparative advantage and structuralism theory as a means of advancing the exigency of diversifying Nigeria's economy. The study concludes that for Nigeria's economy to thrive, post covid-19 , there is an urgent need to harness the potentials inherent in the agricultural and information communication technology (ICT) sectors of the country's economy.

Keywords: Agriculture, Information Communication Technology, Nigeria, Post COVID-19 Sustainable Development

I. INTRODUCTION

The position that the world is gradually becoming a 'global village' came to fore following the outbreak of the novel coronavirus. Some of the ramifications associated with the virus are traceable to the varying degree of lock down measures adopted by governments of nations aimed at checking the spread of the virus to include the closure of states' borders. Other measures include compulsory use of face masks and the observance of social distancing in public places as well as the partial or total shut-down of businesses, recreational centres and institutions of learning. The impact of the global lock down measures are manifest in the fall in international trade. While some businesses and organisations have shut down operations due to low patronage, some others engage in skeletal and/or remote operations. As a result, the rate of unemployment across the world has persistently been on the rise (Emily, 2020). The impact of the coronavirus on the world economy is projected to have more dire impacts on developing countries with growth rate pegged at 0.5% for countries in East Asia, 2.8% in sub-Saharan Africa, and 4.2% for countries in the Middle Eastern (World Bank, 2020).

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As it concerns Africa, the Organisation for Economic Co-operation and Development Report (2020) reports that though the impact in terms of infection and mortality rates are minimal in Africa, the coronavirus has opened up the Continent to dire economic implications. This is because the economies of most countries in the Continent are dependent are arguably less industralised.

Nigeria's economy reflects some of the challenges associated with the coronavirus manifest in the increase of unemployment and poverty rates. While the country's economy has witnessed massive downturns due to the fall in the price of crude oil in the international market prior to and more evident due to the outbreak of the coronavirus, lock down measures adopted by the government have further pushed the country's economy into recession. The near total dependency on foreign exchange earnings from crude oil sale is associated with her dwindling economy (Chukwuma & Mma, 2020) Also, poor economic policies such as the dependence on loans and aids from monetary institutions and donor countries; misappropriation of funds by public office holders are other factors in this regard (Chukwuma & Mma, 2020). Furthermore, the Nigerian government had been contending with a weak economy as a result of the 2014 and 2016 fall in oil price. This pegged her GDP growth to about 2.3 percent in 2019. Similarly, the country's debt profile as well as its debt service-to-revenue ratio estimated at 60% makes economic recovery at the instance of the coronavirus nearly impossible (Chukwuma & Mma, 2020).

The African Post (2020), reports that prior to the outbreak of the coronavirus, unemployment rate in Nigeria was 23.1% high with the Minister of Labour and Employment, Dr. Chris Ngige, projecting an increase to 33.5% by the end of the 2020 due to the outbreak of the coronavirus. With an estimated 86.9 million Nigerians currently living in extreme poverty, it is estimated that about 5 million more Nigerians may slide into the poverty line as a result of the coronavirus pandemic. This is based on the projection that economic growth may fluctuate between 3.2% and 7.4% in 2020 (World Bank, 2020).

At the instance of the vast human and natural resources at its disposal, the Nigerian state arguably belongs among the league of countries with enormous wealth. However, the failure of past and present administrations to diversify its economy manifest in the neglect of some sectors such as the agricultural and information communication technology (ICT), and the total dependence on crude oil exploration has relegated her among the comity of dependent nations. In the 1960s, for instance, agricultural production was the mainstay of the Nigeria's economy; contributing over 50% to its Gross Domestic Product (GDP), and employing a high percentage of its citizens (Effoduh, 2015). Further, despite being among the highest users of ICT in Africa, investment and support for technology by the government is not impressive. The outbreak of the coronavirus has further expanded the country's dependence on technology especially in the conduct of business. Kashifu Inuwa, the Director-General, National Information Technology Development Agency (NITDA) notes that the Information and Technology (ICT) sector's contribution to Gross Domestic Product (GDP) in Nigeria was 14% in first quarter of 2020 despite the economic challenges associated with coronavirus. As at the last quarter of 2019 initial growth stood at 13.12 per cent (Adewumi, 2020); the foregoing speaks to the need to diversify Nigeria's economy.

The study therefore examines the extent to which the potentials in the agricultural and information communication technology (ICT) sectors may be utilized to drive sustainable development in Nigeria, Post COVID-19.

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II. OBJECTIVES OF THE STUDY

The objectives of the study are to:

i. To examine the extent to which the agricultural and information communication technology (ICT) sectors may be utilized to drive economic sustainability in Nigeria at the instance COVID-19; and

ii. To identify the roles of the government at harnessing the potentials in the agricultural and information communication technology (ICT) sectors in Nigeria.

III. LITERATURE AND THEORETICAL DISCOURSE

Nature and Impact of Nigeria's Economic Policies and Programmes: 1999-2019.

This section examines the nature and impact of the economic policies adopted by the Nigerian government following the return to civil rule in 1999. This was with the objectives of reviving Nigeria's dwindling economy. It should be noted that the year 1999 signalled the successful transition of government from military to civil rule.

National Economic Empowerment and Development Strategy (NEEDS): Olusegun Obasanjo Administration (1990-2007)

Prior to the election of Olusegun Obasanjo as President in 1999, the Nigerian state under the autocratic regime of General Sanni Abacha contended with myriads economic challenges. This is associated with the poor human rights records and economic policies characteristic of the regime- actions that attracted sanctions to the country from the international community especially the Commonwealth. Notable among the repressive stance of General Sanni Abacha was the execution on the 10th of November, 1995 of Ken Saro-Wiwa and some chieftains from Ogoni land, a region in south-south region of Nigeria who protested the spate of environmental degradation in the region due to oil exploration (British Broadcasting Corporation, 2016).

Following the election of Olusegun Obasanjo as President in 1999, and in fulfilment of his campaign promises which hinged on re-branding Nigeria's image and economy stagnated by economic sanctions, the government introduced the National Economic Empowerment and Development Strategy (NEEDS) in 2003. This was accompanied by the State Economic Empowerment and Development Strategies (SEEDS) which was implemented in the 36 states of the federation (Okonjo-Iweala & Osafo-Kwaako, 2007). The NEEDS policy aimed at increasing private sector participation and development, vis-à-vis macroeconomic reform, structural reform, public sector reforms, and institutional and governance reform. The overall objectives aimed at reducing the rate of poverty in the country (Okonjo-Iweala & Osafo-Kwaako, 2007). Some of the policies that followed the NEEDS policy included the deregulation of key economic sectors to encourage private sector participation, notably the telecommunications, power, and downstream petroleum sectors (Okonjo-Iweala & Osafo-Kwaako, 2007).

While reforms in the telecommunication sector attracted over US$1 billion in investments with over 32 million users switching to the Global System for Mobile Communications (GSM) from land line during the first four years of the adoption of the policy, the Central Bank of Nigeria (CBN) requested banks to raise their minimum capital base from US$15 million to US$192 million by the end of 2005 (Central Bank of Nigeria, 2006). The policy adopted in the banking in industry aimed at restoring the confidence of shareholders and potential investors in the banking sector. Due to the merger of some banks, the number of deposit banks in the country was reduced from 89 to 25 (Central Bank of Nigeria, 2006).

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Other policy associated with the NEEDS was the reforms that took place in the country's civil service. This led to the retrenchment of over thirty thousand officials, including eight thousand 'ghost-workers'. Similarly, one thousand competent university graduates were recruited into the civil service. Further, while the Economic and Financial Crimes Commission (EFCC) and the Independent Corrupt Practices and other related Offence Commission (ICPC) was established to address the spate of corrupt practices, the Niger Delta Development Commission (NDDC) was established to look into the plight of the Niger Delta people whose communities have been negatively impacted by oil exploration. Equally important, the country received the debt relief package of $18 billion owed the Paris and London Clubs respectively (Okafor, 2014).

As highlighted, the overall objective of NEEDS aimed at reducing the spate of poverty in Nigeria while improving the economy through foreign and domestic investments. Despite the reforms and foreign direct investments (FDIs) the policy attracted to the country, the NEEDS policy failed to achieve its objectives. Poverty levels rose from 54.4 percent in 2004; 60.9 percent in 2010, and 61.9 percent in 2011 (Okafor, 2014).

Accordingly, Bello (2016), notes the country has over the years developed good economic policies. However, the challenge lies in the position that the policies are not people-centred but drafted to suit the wills and purposes of a few elites in the country.

Further, the NEEDS programme was constrained by the poor statistics on poverty rate in Nigeria. As at 2004, 54% of Nigerians lived below poverty line while 22 percent lived in extreme poverty (Bello, 2016). Also, despite the increase in the country's Gross Domestic Product (GDP) from 2003-2007 from 6.59 percent to 7.35%, the impact did not reflect in the socio-economic well-being of the Nigerians, rather, the spate of corrupt practices among public office holders doubled during the period under review (Bello, 2016). It is at this instance that the NEEDS policy failed to address the needs of the masses and by extension, the country (International Development Association and the International Monetary Fund, 2005).

The expiration of the tenure of President Olusegun Obasanjo in 2007 marked the end of the NEEDS policy. While the policy recorded some landmark achievements in Nigeria's macroeconomics, it was unsuccessful in its quest to reduce the challenge of unemployment and poverty in Nigeria. Hence, while the NEEDS policy attracted foreign direct investment (FDIs), and expanded oil exploration and export, sectors such as agriculture and technology among others were neglected.

7-Point Agenda-Umaru Musa Yar'Adua (2007-2010)

Following the 2007 General Elections, Umaru Musa Yar'Adua was elected President of Nigeria. In a bid to fulfil its campaign promises which hinged on turning around the fortunes of the country through the improvement of the sectors that were neglected by his predecessor, the President anchored his economic policies on the 7-Point Agenda. The economic programme identified seven key objectives as its area of focus. The sectors include in no particular order:

1. Critical Infrastructure
2. Food Security
3. Wealth Creation
4. Niger Delta Development
5. Land Reform and Home Ownership
6. National Security and Intelligence
7. Human Capital Development

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Under the aegis of critical infrastructure, the policy sought to revamp core sectors such as the power supply and transportation system like rail, road, water and air. As it pertain food security, the President, possibly noticed the decline in agriculture in the country, and as such included the need to attain food sufficiency as an integral part of his administration's economic policies. While wealth creation had the objectives of supporting small and medium scale enterprises (SMEs) so as to reduce the challenge of unemployment, Niger Delta development concerned the need to ameliorate the plight of the Niger-Delta people whose region is plagued by environmental degradation due to oil exploration (Okorontah & Odionye, 2015). Youth restiveness in the South-South region of the country gave rise to militia groups who engaged in the destruction of oil facilities, kidnap of oil personnel, and demand the control of the resources (crude oil) in the region (Ayogu & Ogunmodede, 2020).

While land reforms and home ownership, on the one hand sought to improve land assets for socio-economic development as well as provide mortgage facilities, national security and intelligence, on the other hand sought to improve the security system of the country. Finally, human capital development aimed at advancing the educational sector (Federal Ministry of Information and Communications, 2007).

While assessing the 7-Point Agenda, Dode (2010 p.6) argued that although the policy objectives were laudable, they were not properly implemented. As it pertain the drive towards food security, farmers were not given the needed support to improve agricultural production in the country. The use of crude farming implements, absence of subsidies for farmers on basic farm implements like fertilizers as well as inaccessibility to credit facilities flawed the objective of advancing food production in the country. Similarly, Ezeibe (2009) note that:

The 7-Point Agenda was shrouded in ambiguities. Hence, its poor implementation allowed some political elites and the technocrats the avenue to amass wealth through the sale and purchase some government's assets. Suffice to say that the policy was shrouded in myths for a better Nigeria.

The above positions were corroborated by Ola (2009) who noted that the 7-Point Agenda only resettled wealth in the hands of some individuals within the circle of the government evident in the far from impressive implementation of the policy. According to him:

While power generation and supply was poor, agitations and violence still existed in the Niger Delta region over the demand for resource control despite granting amnesty to militia groups in the region. Also, the country is far from achieving food sufficiency due to the continued usage of crude farming implements by most farmers. Further, the education sector also lacks adequate facilities to improve learning for students.

It may be argued that the failure of the 7-Point Agenda is traceable to the ill-health suffered by the President which led to his demise. Further, the President before his death failed to hand over the helms to the Vice President, Goodluck Jonathan. This may also account for the failure of the policy hinged on the lack of policy actions/directives and monitoring of the policy occasioned by the President Umaru Musa Yar'Adua's absence.

Following the demise of President Umaru Musa Yar'Adua on the 5th of May, 2010, the Vice-President, Goodluck Ebele Jonathan took over the helms as President. He replaced the 7-Point Agenda policy with the 'Transformation Agenda' otherwise referred to as Vison 20:2020.

Transformation Agenda-Goodluck Ebele Jonathan (2011-2015)

The 2011 General Election led to the emergence of Goodluck Ebele Jonathan as President. It is noteworthy that the President during the election campaign appealed to the emotions of many Nigerians under the slogan of 'I Have No Shoes' depicting his humble background, and the

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quest to meet the needs of the common Nigerian if elected President (Ola, 2009). In a bid to fulfill the mandate of reviving the country's economy, the 'Transformation Agenda' policy was birthed. To this end, a 28-member team was set up to actualise the objectives of the policy. They comprised the President and his Deputy as the Chairman and Vice Chairman and the Minister of Finance, Dr. Ngozi Okonjo-Iweala who doubled as the Coordinator among other imminent personalities with expertise on economics and politics (Gyong, 2012).

While the Transformation Agenda had the overall mandate of promoting economic growth and development in the country, it had three core mandates:

a) Support for large-scale industries, small and medium scale enterprises (SMEs) and promotion of agriculture and information communication technology (ICT) sectors;

b) Human capacity development, youth employment and poverty alleviation; and

c) Good governance (Federal Government of Nigeria, 2011).

It is noteworthy that while the policy had a 4-year short term (2011-2015) mandate to achieve the aforementioned objectives, the long term objective sought to drive Nigeria's economy among the comity of 20 largest economies of the world (Osuagwu, 2013).

The agricultural sector inarguably received a major boost under the leadership of the then Minister of Agriculture, now President of the African Development Bank (AfDB), Dr Akinwumi Adesina whose reforms in the sector made Nigeria attain self-sufficiency in rice and cassava production (Osuagwu, 2013). Other reforms in the agricultural sector include the introduction of the E-Wallet system which made credit facilities available to farmers; made fertilizer distribution more efficient and accessible to farmers especially in rural communities. As a result, food production increased by 21 million metric tonnes during that period. The feat achieved in the sector attracted private sector investments amounting to about $5.6 billion (Premium Times, 2012). On Information Communication Technology (ICT) development another core part of the Transformation Agenda, a Ministry of Communication Technology was created. Also, mobile phones subscription increased to 92.75% from 8.5%. Further, access to the internet increased to 38% from 34% (Osuagwu, 2013).

At the instance of the seeming achievements recorded in the Agricultural and ICT sectors, the country's dependence on crude oil exploration and export persisted. This was manifest in the economic challenges that plagued the country due to the fall in crude oil price in the international market in 2014 (Financial Times, 2016). Nigeria's economy recessed thereby driving inflation rate to 17.1% (Osuagwu, 2013). It may be argued, therefore that the mandate of the 'Transformation Agenda' policy did little to achieve its objectives. This was evident in the persistent rise in corrupt practices by public office holders, insecurity, poor living standard and heightened level of unemployment that characterized the country (Osuagwu, 2013).

The Economic Recovery and Growth Plan (ERGP)-Muhammadu Buhari (2015 till Date)

The year 2015 witnessed a new turn of event in Nigeria's political space. This is so, in that, for the first in the history of Nigeria's politics at the instance of the return to civil rule, an incumbent President was defeated. Muhammadu Buhari of the All Progressives Congress (APC) defeated the incumbent President, Goodluck Ebele Jonathan of the Peoples Democratic Party (PDP) during the 2015 general elections. It is noteworthy that the country was faced with varying socio-economic crises prior to the elections. While the spate of terrorism orchestrated by Boko Haram, armed robbery and kidnapping was on the rise, youth unemployment, and poverty was also on the increase. Nigerians, it may be argued voted out the incumbent President in protest for the myriad challenges facing the country during that period.

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In the bid to address the concerns of the masses, President Muhammadu Buhari adopted the 'The Economic Recovery and Growth Plan (ERGP) as the theme for his administration. The objectives of the ERGP include:

i. Sustained growth to consolidate national cohesion via structural economic transformation;
ii. Efficiency in the public and private sectors and increased national productivity;
iii. Sustainable diversification of production to significantly grow the economy; and
iv. Maximum welfare for the citizens by ensuring food, energy and security (Federal Republic of Nigeria, 2017).

While the policy intended to use science and technology as tools to achieve its set objectives, GDP growth was projected at 4.62% (average annual growth between) between 2017 and 2020. To reduce the rate of unemployment as well as boost small scale entreprises (SMEs), the N-Power and Trader-Moni schemes were introduced. While the N-Power policy had the objectives of employing about 500,000 graduate and non-graduate youths on ago-business, educational among other sectors, the Trader-Moni sought to grant non-collateral loans of Ten Thousand Naira to traders (Federal Republic of Nigeria, 2017).

Although the present administration is still ongoing with President Muhammadu Buhari serving his second term, the objectives of the ERGP seems unachievable. This is due to the impact of COVID-19 on Nigeria's economy. The continued dependence on oil exploration and export has further exposed the economy plunging it into recession (Aljazeera, 2020).

From the foregoing, it will be observed that since 1999, efforts of past and present administrations towards resuscitating the country's economy led to the development of different economic policies. While the policies had good objectives, the drawbacks are traceable to poor policy implementation, absence of policy continuity as well as the continued dependence on oil exploration and export. To this end, Onuche (2018) argues that:

Absence of policy continuity since the transition to civil rule is a major challenge affecting Nigeria's economy. Hence, for Nigeria to forge forward there is an urgent need for the President Muhammadu Buhari-led government to reconcile the principal objectives of the ERGP with those of past policies like the Transformation Agenda as well as the 7-Point Agenda (p.15).

a. Technology Innovation and Adoption in Nigeria

The level of technology adoption remains one of the pointers with which to measure the level of development of a country. This is so given the many benefits and ease technology brings to the fore in the conduct of everyday life. In the past six years, global tech-brands like Amazon, Apple, Facebook, and Goggle are among the big earners in terms of revenue generation. For instance, Amazon has since 2017 till the first quarter of 2020 witnessed increasing annual revenue. While the annual revenue for 2017 was $177.866 billion, a 30.8% increase from 2016, revenue for 2018 stood at $232.887 billion, a 30.93% increase from 2017 (Macrotrends, 2020). In the year 2019, annual revenue was estimated at $280.522 billion, with an increase of 20.45% from 2018. For the first twelve months ending June 30th, 2020, revenue stood at about $321.7828 billion, suggesting an increase of 27.66% year-over-year (Macrotrends, 2020). Further, the annual revenue of Facebook is reported to have grown from $7.87 billion in 2013 to $70.7 billion in 2018. As at 2019, annual Facebook revenue was reported to be about $70,697 million (Statista, 2020).

Despite being the second largest economy in Africa with a number of reputable firms and small and medium scale entreprises (SMEs), Nigeria is largely deficient in technology innovation and

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adoption. Okundaye, Susan and Dwyer (2019) note that adoptive technology instruments and usage is at its lowest ebb in Nigeria. This according to study is manifest on the dependence of most businesses in Nigeria on human efforts rather than on technology which drives efficient service delivery.

Popoola (2018) notes that the level of technological adoption and innovation in Nigeria is far from impressive. He furthers that the deficiency in the sector is attributable to the low level of support for the technology development manifest in the government's failure to key into the benefits associated with technology. Also, technology education, according to him needs to be encouraged in schools. Similarly, businesses should also be encouraged to adopt innovative technologies (Popoola, 2018). Further, Adim (2019) suggest that one of the challenges confronting technology development in Nigeria lies in the cost of running a technology-driven company, distrust for technology usage by some entrepreneurs as well as the government's failure to support technological innovations.

Oodee and Dickson (2017) submit that while businesses across the world have evolved technologically, businesses and organizations in Nigeria still depends on obsolete technologies. The downside in this regard lies in the inability of some Nigerian brands to cope compete with global brands. Similarly, Onipede (2017) while examining technology and industrialisation in Nigeria aver that the decline in the level of industrialization in Nigeria is associated with poor technological innovation and adoption. The challenge lies in the absence of institutional support for technology development in the country The study further suggests the need for the development of indigenous technologies that would act as a catalyst for industrialization.

While a few indigenous ICT firms like Zinox Technologies, Omatek, Interswitch Nigeria among other tech brands in Nigeria are striving to bridge the gap in terms of providing ICT solutions in Nigeria, little or no support are accorded them by the government in terms of patronage and tax waivers.

b. AGRICULTURAL DEVELOPMENT IN NIGERIA

During the earliest days of Nigeria's independence, agriculture was averred to be the pillar of Nigeria's economy. The sector arguably employed a large percentage of Nigerian youths, guaranteed food sufficiency leading to export. It is often argued that revenue from agricultural exports played a key role at establishment some infrastructural facilities and government establishments that have endured till date. Institutions like the University of Ibadan, University of Ife now Obafemi Awolowo University, Ile-Ife, Ahmadu Bello University, Zaria and University of Nigeria, Nsukka established in 1948, 1962, and 1955 respectively were arguably established with revenue generated from agricultural export (Nnabuife, 2014). The regional system in practice at that time allowed the three disparate regions to development at their own pace while royalties were paid to the government. The massive agricultural produce such as the cocoa in the west, oil palm and rubber in the east and mid-west, and groundnut production in the north were a force to reckon with in Africa. The massive groundnut pyramids in the North was a testament to the massive agricultural production that took place in the region at that time. Nnabuife (2014) argues that the groundnut pyramids in the northern city of Kano is a reflection of the extent to which agricultural production played a key role to Nigeria's economy in the 1960s. The pyramids doubled as both a tourist attraction and a source of wealth for the northern region.

The discovery of crude oil as well as military involvement in Nigeria's politics distorted the near perfect economic structure of the country, leaving the country dependent on petrol-dollar,

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while agriculture was relegated to the background. The Council on Foreign Relations (2019) contends that:

Nigeria is largely oil dependent and not oil rich. The vigorous exploration of oil in the 1970s distorted the fiscal and economic policy of the country. The implication is evident in the position that oil sucked-up domestic and foreign investment at the expense of other sectors of the economy. The Military government further set the country's economy on the path of woes through unstable policies (p.2).

While accessing the state of agriculture in Nigeria, Ogbalubi and Wokocha (2013) opines that in the 1960s, agriculture employed about 70% of Nigeria's active population. However, the discovery of crude oil and the failure of the government to utilize the potentials in the sector despite the adoption of various agro-based policies like the Green Revolution of the 1970s have undeniably made Nigeria become an importer rather than an exporter of agricultural produce. The poor level of technological adoption contributed to the decline in agricultural production, especially as the use of crude implements by farmers only guaranteed subsistence farming (Ogbalubi & Wokocha, 2013).

Similarly, Salihu et al. (2012) in their study states that the desire of the government to attain sustainability in the agricultural sector led to adoption of agro-based policies like the National Accelerated Food Production Programme (NAFPP), Operation Feed the Nation (OFN), Green Revolution among others policies. However, the government's indifference to exploring the potentials in the sector has seemingly made it unattractive especially to the Nigerian Youths.

Taking into account the failure the Operation Feed the Nation programme initiated by General Olusegun Obasanjo in 1976, it may be argued that the policy was orchestrated to fail, and devised as a reward to then military administrator (General Olusegun Obasanjo) who allowed for the successful transition to civil rule. It is noteworthy that what is today referred to as 'Obasanjo Farm Nigeria Limited' situated at Otta, Ogun State was established in 1979, three years after the seeming failure of the Operation Feed the Nation programme.

Furthermore, Adeola and Oluwafemi (2014) opine that Nigeria's vast and arable land supports in all its totality agriculture. Hence, the quest to achieve food sufficiency should not be a form of challenge for the country if the various policies adopted by the government to drive agricultural production had been properly implemented and utilized. Today, a country expected to be a major exporter of agricultural produce is experiencing food crisis, and tending towards famine; threat of hunger and poverty with a large proportion of the populace (70%) living on less than a Dollar per day.

IV. THEORETICAL FRAMEWORK

The study adopts comparative advantage theory and structuralism as the theoretical framework for the study.

The comparative advantage theory is attributed to Davido Ricardo in his book titled 'On the Principles of Economy and Taxation' published in 1817. Ricardo argued that a country can better attain economic growth by focusing on industry in which it has comparative advantage. The theory therefore suggests that countries in a bid to achieve their desired economic goals and objectives will produce more of goods which they have comparative advantage over, and less of others that they are deficient at (Kimberly, 2020). Hence, comparative advantage allows a country to produce goods or services with which it has a lower opportunity cost than other countries (James, 1884).

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Structuralism is situated among the theory of development which explains the process of development a country is expected to go through to attain economic growth and development. Structuralism as a theory of development is associated with largely Latin America scholars like Raul Prebisch, Celso Furtado, Anibal Pinto, Osvaldo Sunkel among others (James, 1844).

The theory argues that for a country to attain sustainable development, it must transform its economy through the adoption of technology that would drive industrialization thereby increasing export over import of good and service. Hence to attain development, a country is expected to end its reliance on the export of primary goods. Further, the government, according to structuralists have a key role to play in the quest to attain a self-sustaining growth by the way of making informed economic policies like granting of tax waivers to small and medium scale entreprises (SMEs) (James, 1844).

At the instance of the fall in price of crude oil in the international market as well as the economic challenges associated with the coronavirus pandemic, utilizing the advantage Nigeria has in agriculture made possible by its vast and arable land may drive economic growth, and as such promote export over import of agricultural produce. Further, industrialization can also be achieved such that it drives economic sustainability if the government promotes the potentials inherent in information communication technology (ICT) at the instance of the seeming human restriction the coronavirus has brought to the fore.

V. METHODOLOGY

The study adopted qualitative data method. Hence, purposively selected respondents with expertise on the subject were interviewed. They included economists, agricultural-economists, farmers, software consultants and developers, personnel of Lagos Chamber of Commerce and Industry and Nigerian National Petroleum Corporation (NNPC). The data gathered was analyed via discourse analysis.

VI. AGRICULTURAL AND INFORMATION COMMUNICATION TECHNOLOGY (ICT) AND SUSTAINABLE DEVELOPMENT IN NIGERIA

This section presents and analyses the views of the respondents on the above theme. While reacting to the extent to which agriculture and information communication technology may drive sustainable development in Nigeria, Respondent[1] argues that the agriculture remains the highest employer of labour in the Nigeria; made possible by the arable lands that country has at its disposal. He noted also that the potentials in the agricultural sector goes are beyond tools for survival but can serve as channels of investment and business opportunities. This is because one third of the country's land space has not being farmed. Furthermore, Information Communication Technology (ICT) may be likened as the 'New Gold' given the many opportunities it bears within it. He opined that:

Young Nigerians are fasting catching up in the trend through the development of applications and drones bringing to bear the synergy between agriculture and ICT. Drones may be deployed to map large expanse of lands. Also, young farmers are taking advantage of the social media platforms to advertise their commodities aimed at expanding their network of clients.

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On the extent to which agriculture may drive sustainable development in Nigeria; Respondent[2] noted that there seems to be too much emphasis by the government on certain crops like rice farming. He submits that:

Crops like Castor and Shea Butter which Nigeria has the arable land and advantage over in terms of production is currently in high demand in Europe due to its health benefits. Additionally, these crops are perennial crops, and do not need special care. Additionally, these crops do not harbor virus and parasites nor require any form of preservatives during export. Beans produced in Nigeria, for instance, are not accepted in Europe because of the nature of chemicals used in preserving them. Castor and Shea butter farming alone can generate millions in foreign exchange earnings for the country.

Respondent[3] states that in the 1960s, Nigeria had a viable agricultural sector, one which saw her farm in commercial quantities Cocoa, Groundnuts and Rubber for export. The economy was good, so much that, a Dollar was equivalent to one Naira. Poor policies implementation since led to the collapse of the sector. Furthermore, he stated that 'there is need for genuine government support for agricultural production and not just the emphasis on rice production which led to the closure of the borders to curb the importation of rice. Support for Cocoa, Groundnut, Palm Oil among other agro-produce especially at the rural communities will act as a catalyst to advance the country's economy in the face of the persistent fall in Crude Oil prices in the international market. Take the Nigerian rice as an instance, patronage is low because they are stony evident by poor processing facilities. It takes government's sincere quest for attaining food sufficiency to make the agricultural sector work.'

Furthermore, Respondent[4] was of the opinion that diversification is not only mandatory but urgently required for the constructive, innovative and sustainable development of Nigeria. Hence, for Nigeria to build a sustainable economy, the government must re-think and re-imagine her National Development Policy Strategies and implementation plans or perish poorly. While reacting to the extent to which ICT may advance sustainable development in Nigeria, the respondent argued that 'to avoid emerging catastrophes in Nigeria's and indeed Africa's digital future, rethinking our national Science & Technology education and ICT strategy – beyond local content in Oil & Gas – has become a matter of critical urgency, for many cogent reasons. The first sustainable reason is that Software Applications, Solutions, and services will rule the world's employment and economic development space and value-chain for an exceptionally long time aimed at guaranteeing not only the country's survival but advancing sustainable development.

Accordingly, Abolade and Durosimi (2019) submits that Nigeria, like the rest of the world in a bid to enjoy the benefits globalization brings to the fore, should adopt information and communication technology (ICT) as a medium to meeting the everyday need of Nigerians whether in business or in the provision of basic essential services. Similarly, Adeola and Oluwafemi (2014) states that the agricultural sector has proven to be the most consistent and reliable sector in Nigeria, since independence. Hence, informed policies in the sector aimed at diversifying the economy remains the bedrock for Nigeria's quest to attain economic sustainability

Respondent[5] notes that 'ICT may drive sustainable development in Nigeria. This is premised on the position that the ICT sector in Nigeria is growing with a large number of experts thriving on the job. The challenge is that these experts tend to leave Nigeria in search of better working conditions abroad owing the economic situation of the country.' Also, Respondent[6] states that before the commercialisation of oil and gas, the agricultural sector used to be the mainstay of the economy but the nation was wooed by the seeming benefits inherent in the Oil and Gas sector, and has abandoned the agricultural sector. He furthered that the kind of agricultural

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system that is practised in Nigeria does not yield much value to the Nigerian's economy due to the primitive methods of farming largely adopted in the sector. Hence for agriculture to add value to Nigeria's economy, there is a need to promote commercialised and mechanised agriculture. On the other hand, the advent of Covid-19 has made us discover new ways of doing business, the government could leverage on ICT to add more value to the economy. Interestingly, the top largest companies in the world are ICT-driven (Amazon, Google, Facebook, Microsoft). This seems to suggest that the future of the world is knowledge-based and not on mineral resources which Nigeria has held on to for many years.

Respondent[7] opined that Nigeria's economy has been dependent on the fortunes from oil such that the economy shrinks with the slightest shrink in the price of oil in the international market. Hence, the urgency and essence of diversification to take place especially in the area of Agriculture, Information Communication Technology, Tourism, Solid minerals and others. The above position was supported by Respondent [8] and [9] who argued that Nigeria's economy has always been mono economic, in that there has never been a time when more than one industry has competed actively to sustain the economy. They furthered that: ICT and Agriculture by today's economic categorization are two stand-alone industries with unique and complementary potentials. One unique feature of these two sectors are the easy of entry for all levels of social class of and organizations, as well as the complementary aspect of enhancing usage and quality. Nigeria, at the instance of the volatility of the oil markets needs urgent intervention, post-COVID so as to enable her seamlessly adapt to global trends and as such, stimulate economic activities which can bring about meaningful national development

Additionally, Respondent[10] while reacting to the extent to which the agricultural sector may drive sustainable development in Nigeria noted that the agricultural sector does not only provide food but also acts as a major source of revenue generation for countries' that harness the potentials in the sector. Respondent [11] advanced that despite the decline in terms of support to the agricultural sector by the government, it still employs about 67% of the country's population. The potentials in agriculture, especially in Nigeria cannot be over emphasised. So far, the failure of the Oil and Gas sector to drive a sustainable development over the years is a call for the Nigerian government to diversify the economy using the ICT and agricultural sectors as tools.

VII. ROLES THE GOVERNMENT CAN PLAY AT UTILIZING THE POTENTIALS IN AGRICULTURE AND INFORMATION COMMUNICATION TECHNOLOGY (ICT) TO ADVANCE ECONOMIC SUSTAINABILITY POST CORVID-19

In a bid to examine the above theme, different views were expressed by the respondents. Respondent[12] noted that the government has a major role at utilizing the potentials in the Agricultural sector. He notes that there is a need to invite investors to drive rice production, for instance, in Nigeria through a public-private partnership venture. According to him-there is a need for the agricultural research institutes in Nigeria to be revived and made more proactive in their responsibilities of supporting the agricultural sector in the country. Also, the government should adopt sound policies that would support agricultural production whether in rural or urban centres. The advantage this will afford the country and the agricultural sector would be manifest in an all-year round agricultural production. Further, value addition remains core to the agricultural sector. The continued export of raw agricultural produce in exchange for processed food has over the hindered the growth of the sector. Therefore, the government should invest heavily in commercial agriculture, such that Nigeria will have the capacity to

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process what it produces. This will put an end to the lopsided terms of trade we have with countries abroad.

Respondent[13] averred that the failure of the government to support rural farmers remains a major challenge affecting the agricultural sector. He noted that the challenge of insecurity in regions notable for agriculture like Benue, Adamawa, Bornu, Kaduna and other parts of Northern Nigeria due to the spate of farmers-herders' crisis and insurgency among major factors affects agricultural production in Nigeria. Further, the government should re-initiate the E-Wallet policy adopted by during the administration of President Goodluck Ebele Jonathan. The advantage the policy the policy brought to the agricultural sector through direct contact with farmer was evident in the degree of development witnessed in the sector as well the amount generated during that period through the agricultural sector. Similarly, the government should promote the farming of crops like Castor and Shea-butter which we have massive advantage over and which in high demand in Europe given its health benefits. According to the report released by Cellulant (2019), the adoption of the E-Wallet scheme made agriculture financing easy in that it allowed the government of Nigeria direct access to farmers especially in rural communities. This has made the distribution of fertilizers, farm seedlings and access to loans for farmers available to farmers in the country.

Respondent [14] suggested the need for the government to adopt policies that will breed value addition in the agricultural sector. He further stated that:

The export of raw materials to Europe will continue to affect negatively agricultural produce in Nigeria unless the government invests heavily in processing plants. This way, we are able to process our raw materials rather than export them at cheap rates abroad. If that is achieved, the government may take advantage of the regional institutional arrangement under the aegis of African Union, ECOWAS among others to advance trade in the Continent.

Similarly, respondent [15] opined that while revenue in the IT Services market is projected to reach US$930,028m in 2020 – a growth of 7.8%; revenue in the Software market is projected to reach US$503,663m in 2020. Further, the market's largest segment is Enterprise Software with a projected market volume of US$195,100m in 2020. Revenue is expected to show an annual growth rate (CAGR 2020-2025) of 9.1%, resulting in a market volume of US$779,720m by 2025. According to him:

Policy Makers has a mandatory responsibility to deploy resources and facilitate Fiscal Strategies to empower the nation and her people to Innovate. This innovation process cannot be devoid of Science, Technology, Engineering and Mathematics (STEM). Government is defined as an institution of the people by the people for the people. Indeed, Nigeria should not be begging for what she already has in abundance; that is human resources. We the people of Nigeria owe it a duty to ourselves, families, the nation and the world to master the Tech-Biology of things for progress. Finally, the cumulative potentials of Software/ICT Solutions and services currently developed and supported by Nigerians all over the world, is worth over 200billlion USD – including unaccounted Patents and IP missing in digital action (MIDA). Problem is, we currently don't have the commensurate data to proof this, due to the seeming neglect of critical Baseline studies and blatant appointments of unmerited hands to implement and deliver the IT-Innovation-of-Things at many critical and sensitive levels. That is where the world is heading. The following are glaring example of the economic power of Software around the world:

Similarly, respondent [16] remarked that:

The bulk lies with the government to provide a conducive environment for ICT in the country. There is no denying the fact that Nigeria boasts of young and talented personnel versed in ICT, who are contributing their quota to tech development. Adequate support in all perspectives will

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reduce the impact of COVID-19 by creating virtual job opportunities with little or zero need for physical appearance and as such drive growth in E-commerce which would drive sustainable development in the country.

Furthermore, respondent [17] stated that:

The government needs to take a bold step and set the pace for the citizens. The Nigeria government can invest massively in agriculture. On the other hand, the bedrock of the ICT lies in education. The Nigerian government needs to invest on the educational sector such that attention is given to persons interested in agriculture and technology. On graduation, they should be accorded support like soft loans to help them stop up at small scale levels. Therefore, for us to develop, the Nigeria government has enormous role to play so that ICT and agriculture would add value to the economy we need to embrace knowledge economy and move away from oil and gas.

Furthermore, respondent [18], in his opinion argued that the Nigerian government can build technological institutions and firms aimed at creating an enabling and conducive environment that would attract foreign investors in the agriculture and technology sectors in the country.

VIII. CONCLUSION

The study found that the human and mineral resource the Nigerian state has at its disposal inarguably makes it one of the wealthiest countries in the world. However, the country's continued dependence on oil exploration and export since the 1970s has exposed her to many economic challenges, chief among is inflation which is responsible for the dwindling rates in the price of oil in the international market; a feat that has further expanded the rate of poverty in the country. Also, the failure of the government to adopt structurally sound policies that would ensure the effective diversification of (Nigeria's) economy by way of utilizing the potentials inherent in other sectors like agriculture and ICT has further exacerbated the country's economic woes at the instance of covid-19. T

Furthermore, the study established that Nigeria has comparative advantage in agriculture due to its vast and arable land. The study also revealed that ICT is one of the leading sectors driving revenue generation across the world post covid-19. The study therefore suggest the (urgent) need for the Nigerian government to tap into potentials available in the agriculture and ICT sectors by way of encouraging firms operating in the sector by way of offering them tax holiday, low interest loans, and subsidies for technology-driven farm implements.

The study therefore concludes that for Nigeria's economy to survive post-covid-19, there is an urgent need for the government and those at the helm to diversify her economy using the agriculture and information communication technology (ICT) as tools to advance sustainable development as this will drastically reduce the country's dependence on crude oil export.

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