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RESEARCH OF LAVENDER PLANT PROPAGATION IN THE PROVINCE OF DIYARBAKIR

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Abstract: *Lavender flowers are from the family Ballibagiller (Labiatae) and grow in North westand South west Anatolia Between June and August, blue or purple flowers open, 20-60 cm in length, aromatic smelling, perennial, herbaceous or playful plants. More widespread in western regions where marine climate is present.There are two species that grow in Turkey. These are Lavandula x intermediave and Lavandula angustifolia Lavender is an important perfume, cosmetics and medicine plant cultured in the world due to its high content and high quality oil content The purpose of our research is to cultivate this plant and to revealits medicinal and aromatic properties. In the study, pre-seedling stems were prepared from 'Raya', 'Silver' and 'Vera' lavander varieties of Lavandula angustifolia species as field materia land 'Giant, Hid, cote', 'Dutch' and 'Supera' lavandin varieties of Lavandula x intermedia species and selected the 'Super A' lavandin variety of Lavandula x intermedia that could be adapted in Diyarbakir conditions. Production and reproduction of lavender plant as in other aromatic plants arecarried out in two main ways, generative and vegetative. However, because of the in fertility of the 'Super A' lavandin variety of Lavandula x intermedia crewand the lack of seeds, vegetative propagation ands hoot steels were used. The seedlings of the "Super a" lavandin of the Lavandula x intermedia line were placed 1 m abovetherowand 3 m apart from the row, in the experimental area of the Dicle University MedicalandAromatic Plants Application and Research Center 7 days a week 6-7 April 2017. A total of 2100 seedlings were planted in the trial area and later juveniles were given. The maintenance and irrigation works of the seedling lites were carried out regularly at the trial and drip irrigation system was used in the study. At the beginning of June some of the seedling lites were found dead. The survival of the remaining seedling lites continued and the adaptation rate was 63% Flowering The flowers were harvested 3 times betweenJ une and October, which began in June. In December, the shoot steels were rooted in the serpentine and replicated in the plants we obtained for seedling formation At the and of this study; 21-33 cm long plants were obtained, These results formed the opinion in light of lavender farm will be made in Diyarbakir in Turkey. This year we will also work on the determination of the medical and aromatic contents of plant materials obtained from our work.*

Key Words: *Lavender, seedling, steel and planting*

1. Introduction

In recent years, the demand for herbal medicines for treatment, the perfumery of fragrant plants, the formation of the main raw materials of the food and cosmetics industry and the emergence of new areas of use have increased the demand for medical and aromatic plants. Raw materials obtained from these plants have recently been used in the food industry, especially in the industrial sectors such as paint, ornaments, and they have begun to spread [15].

Lavanta is most prevalent in southern Europe and in neighboring countries of North Africa [8], especially in the Mediterranean and Balkan countries. France, Bulgaria, Spain, Italy, Greece, England, USA, Russia, Austria and North Africa [22].

Lamiaceae (Labiatae) family is represented in the world with about 224 genera and 5600 species, Turkey constitutes one of the Lamiaceae family of genes important for the center. Additionally, this family of 45 genera in Turkey, there are 565 species and 735 taxa [12]. The important species of this family, which are medicinal and aromatic, are Mintha, Thymus, Origanum, Sage, Sideritis, Melissa Rosmarinus and Lavandula [14].

The real lavender plant is a semi-annual plant, a perennial plant. As you get older, a large number of branches are formed, starting from the bottom upwards, with an average length of 40-60 cm and a maximum length of 1.2 m. There are mutually 2-5 cm long, short-stemmed, greyish-green leaves in the dahlia, and the flowers are gathered at the ends of the stems 15-20 cm long resembling the head of the head. There are an average of 6 flower clusters in each spike and 5-20 flowers in each cluster. The flower clusters are protected by two sheets facing each other. The actual lavender flowers, which are very short stalks, are wrapped in gray-blue color, with straight, bright, non-hairy 4-6 mm long dish leaves. The leaves of the dish wrap around like a flower pipe and end with 4 small pointed teeth at the end. There are four male organs among the petals that vary from violet to violet [13-17].

The real lavender is rich in limestone, and has developed very well in dry and calcareous soils with a pH of 5.8-8.5. It produces less volatile oil in soils that are extremely humid, have a high base water and a high proportion of organic matter. It is originated from the Mediterranean and is very resistant to stasis and temperature. However, the resistance to cold is not as high as the resistance to stasis. Cold weather can sometimes be seen in regions where winter is very hard. The southern-facing, dominant winds are less cold-covered in sloping areas. However, in sloping areas, the direction of planting is planned to be steep [4-16].

The most Lavander in the World (L. angustifolia Mill.) and lavandin (L.x intermedia Emeric ex Loisel.) agricultural varieties into their species maintained, while in Turkey in economic terms only lavandin in Isparta (L.x had intermedia. Super A) culture is done. Lavender has adapted very well to this irrigation, barren and sloppy land. [7].

There is intermedia L. grown in Isparta. Fresh lavender with an average of 500-750 kg / da is taken from the Supera lavandin variety. After drying, 100-150 kg / da dry flower yield is obtained with the sap leaves. When fresh bunch of 5 kg stems are dried, about 1 kg of stemless dry lavender flowers are produced. 65% of the dried stem flower bundles are sap, 35% are fruit [5].

Production and multiplication of lavender plant as it is in other aromatic plants is done in two main ways, generative and vegetative. Some types of lavender are generative only, some types are vegetatively, and some types of lavender and varieties of lavender can be reproduced more easily and quickly in both ways. [3-6].

In medicinal and aromatic plants, the active substances vary depending on the genotype and the environment. The characteristics of the plants such as metobolite extractions, volatile oil composition, volatile oil content, age and dry drug yield may vary. Tissue culture technique micro-cultivation method has the same genetic structure to eliminate the negative aspects of seed and steel production, allowing vegetative propagation of seedlings quickly and in large quantities. In addition, micro-production techniques in medical and aromatic plants, which are particularly sensitive to environmental conditions, can be considered as an alternative form of production to traditional production methods [11-19-20].

In addition, in order to obtain a large number of seedlings, it is necessary to encounter difficulties in obtaining suitable steel, and a large rootstock garden to be taken of the steel. In seed production, development is generally slow, seed germination problems can occur, and there are large variations in morphological and volatile oil composition due to foreign pollination [18].

Since lavender is a perennial plant, it is economically beneficial for at least 15 years from the same lavender plantation. Lavender steels are mostly planted in early spring or early summer [10].

Lavender plants begin budding in June and bloom in July. Flowering time varies depending on species and variety, climate and soil conditions, altitude and region. Harvest time in lavandula is very effective on the yield and quality of essential oils [21].

The increase in interest in lavender farming in recent years has increased the importance of scientific research on this plant's advanced breeding techniques and made significant improvements. Studies on the propagation of the steel have gained tremendous value, especially in species with seed multiplication problems. Smoking irrigation of Isparta province, arid areas and slopes to extremely good harmony lavender, which provides a dry crops, if it is determined varieties that produce volatile fatty marketable quality in the world and then can be distributed determined to rapidly reproducing manufacturers seedlings of these varieties, lavender and Isparta big win for both Turkey's economy [2].

The purpose of this research; lavender cultivated economically in Turkey made only in Isparta region for higher flower yield and high volatile oil quality (containing high proportions of linalyl acetate and low in camphor) has, adaptability high lavandin varieties Diyarbakir and to provide the local and this kind of agricultural and to determine the technological properties, to adapt to in vivo conditions of lavender cultivar with limited possibilities of production with seeds and sometimes even impossible, and to investigate possibilities of propagation by means of steel, to produce a large number of healthy seedlings from mature lavender plants.

2.Material and Method

2.1.Research Place and Year

Field experiment, Dicle University Medical and Aromatic Plants Application and Research Center between April 6, 2017-2018; The sera experiment was carried out in 2018 in the Medical and Aromatic Plants Application and Research Center.

2.2.Plant Species Used in Research

In the study, "Supera" from Egridir Fruit Research Center located in Eğridir district of Isparta province was used as material by taking fidelity of variety. This variety is one of the most important

varieties used in the production of commercial lavender in the world. The location obtained with the lavandin type used in the experiment is given in Table 1.

Table 1. The type of lavandin used in the research and its origin

Type	Variety name	Trade name	Origin(where available
L.x intermedia	Super A	Lavandin	Türkiye-Isparta

The characteristics of variety used in the research are briefly mentioned below by making use of "Anonymous [1]".

2.3.Soil preparation

Dicle University Medical and Aromatic Plants Application and Research Center area on April 6, 2017 140x30 m (4.2 decares) area is determined. Immediately prior to planting, fertilization was carried out in such a way as to be 6 kg N, 6 kg P2O5 per decare, which is widely applied in the area. Land was cultivated before cultivation. Lines were then opened with row openers to form rows and rows of 3 m and a drip irrigation system was established after the soil was left to rest. The struggle with weeds was carried out by rotating them with a rotator, and the rows were processed with anchors.

Table 2. Monthly climate data for the period of the experiment *

MONTHS	TEMPERATURE			RAINS			HUMIDITY(%)		
	HİGH	AVG	LOW	HİGH	AVG	LOW	HİGH	AVG	LOW
JANUARY	12	7	-4	4,1	0,5	0	100	71	13
FEBRUARY	18	8	-2	0,5	0	0	100	62,3	6
MARCH	20	9,16	-1	10,9	1,8	0	100	68,48	14
APRİL	26	12,26	0	16	1,8	0	100	67,63	14
MAY	33	18,41	7	9,9	0,8	0	100	57,03	7
JUNE	42	25,7	12	3	0,1	0	77	29,2	4
JULY	43	31,22	19	0	0	0	49	18,67	4
AUGUST	44	30,06	17	0	0	0	52	22,06	4
SEPTEMBER	40	26,26	13	0	0	0	58	21,36	4
OCTOBER	29	17,09	6	21,1	1	0	100	38,09	7
NOVEMBER	21	10,06	-2	5,1	0,3	0	100	66,66	20
DECEMBER	17	6	-5	2	0,2	0	100	73,45	16

*Diyarbakır Regional Directorate of Meteorology 2017 records

2.4.Preservation of seedlings

In the study, the roots of the 'Supera' lavandin from Eğridir Fruit Research Center located in the district of Eğridir in Isparta province were kept in water for 1 day before fiddling and then planted.

2.5.Seedlings planting

A total of 1552 seedlings were planted in the previously prepared 140X30 m (4.2 decare) area of the 'Super A' lavandin, previously moistened with roots in water. Then, after the sewing operation was finished, the drip irrigation system was opened and all the seedlins life waters were given.

There is intermedia L.x. Super A; In June and July, long flowers are blossoming, bluish purple color, flower stalks are long, sharp fragrant, leaves are silvery green, frequently arranged, branches are very long and semi-slanting up to 90 cm, volatile oil and flower is high, used as ornamental plant a kind of lavandin .

3. Findings and Discussion

In the research conducted between 2017-2018, there are intermedia of lavandin L.x in the ecological conditions of Diyarbakir. The adaptation, flowering stage, yield and harvesting period of the Supera variety were investigated in vivo.

3.1.Adaptation of the planted Supera 'lavandin variety seedlings and flowering phase

In the research, irrigation and maintenance operations were carried out continuously after the planting phase of the 'Supera' lavandin type fidelites taken from Eğridir district, Eğridir Fruit Research Center in Isparta province. There is intermedia L.x. The adaptation of the Super A plant is almost ensured. The first weekly plantings of the fidelites planted in May, June, July, August, September and October were observed, and the numbers of plants adapted to flowering and flowering were determined (Table 3).

Table 3. The results of the adaptation and flowering stages of the planted Supera 'lavandin variety seedlings

MONTHS	LIVING PLANT NUMBER(%)	NUMBER OF BLOOMİNG PLANTS
MAY	45	0.0
JUNE	55	1155
JULY	60	1230
AUGUST	63	1323
SEPTEMBER	63	1323
OCTOBER	63	1232

*The data were taken at the end of each month.

3.2.There is intermedia L.x. The yield and harvesting period of Super A 'lavandin plant

Lavender reaches the full bloom cycle in July, with varying species and varieties, climate and soil conditions, altitude and direction, and is harvested during this period. There is intermedia L.x. The adaptation of Supera plant in Diyarbakir conditions and harvesting after the flower period reached the end of June. Sowed grass knives are used in the harvest of the plant. However, the yield was low because the yield was low in the first year. [9], reported that first year yield was not obtained in

lavender cultivation and that yield was started to be obtained from second year. This supports the quality of our work.

In recent years, harvesters have been harvested with gasoline hedge mowers. Machine harvesting saves labor and time.

The harvested flowers were laid out in a shaded environment at a thickness that would not create an escape. Dried lavender flowers with the handle were separated by hand from the stems and the number of flowers on the surface was noted (Table 4).

Table 4. There is intermedia L.x. The yield and harvest period results of the Super A 'lavandin plant

MONTHS	NUMBER OF FLOWER	NUMBER OF FLOWER AT HARVEST TIME
MAY	0.0	0.0
JUNE	2310	0.0
JULY	2460	18450
AUGUST	2646	0.0
SEPTEMBER	2646	0.0
OCTOBER	2646	12320

*The data were taken at the end of each month.

4. Results

In recent years, agriculture of medicinal and aromatic plants, which are used for pharmaceuticals, cosmetics, perfumery, industry and food and have important share in exports, is becoming increasingly widespread. In medical plants, quality concept is more important than efficiency. Because the plants that are actually used and effective in these plants are the substances in the composition of that plant. Therefore, the scientific researches on quality improvement enhancing techniques have been increased and significant developments have been recorded.

Production and reproduction of the lavender plant as it is in other aromatic plants is carried out in two main ways, generative and vegetative. However, because of the infertility of the 'Super A' lavandin variety of Lavandula x intermedia species and the lack of seeds, vegetative propagation and fleece obtained from shoot steels were used. A total of 1552 seedlings were planted from the 'Super A' lavandin variety of Lavandula x intermedia line, from the field of Dicle University Medical and Aromatic Plants Application and Research Center to the field of 4.2 and April 6, 2017 in the field. Observations during the months of May, June, July, August, September and October of the survey showed that some of the fidelites had died. The survival of the remaining fidelites continued and the adaptation rate was 63% in the trial area. Flowering The flowers were harvested 3 times between June and October, which began in June. At the end of this study; 21-33 cm long plants were obtained. This results in light of lavender farm in Turkey, was concluded in Diyarbakir to do outside of Isparta.

In the next step, we will work on the production of the herbal materials obtained from our work in steel, in vitro and in vitro, and on the determination of their medical and aromatic contents.

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EXISTENCE OF A SOLUTION OF A REACTION-DIFFUSION TYPE OF PROBLEM AND AN APPLİCATION

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Abstract: *We study the existence of solution of a reaction-diffusion type of problems. Then the technique used in the proof applied to get an approximate solution of a reaction-diffusion type of problem.*

Key words*: Monotone positive solutions, Second order nonlinear differential equations, reaction-diffusion process.*

1. Introduction

In this paper, we consider the solution of a reaction-diffusion process governed by the nonlinear second-order equation

$$x'' + x^p(t) = 0, 0 < t < L, p > -1,$$

where L is the length of the sample (heat conductor), p is the power of the reaction term (heat source), subject to the boundary conditions

$$x(0) = 0, x'(L) = a.$$

Negative integer, radical and decimal powers for the Dirichlet type of boundary conditions were considered in [1--4].

We use a new approach to show the existence of the positive solution. Then the approach in the proof is used to find a numerical (approximate) solution of a reaction-diffusion problem.

2. Main result

Without the loss of generality we take $L = 1$.

Theorem. The (reaction-diffusion) problem

$$x'' + x^p(t) = 0, \ t \in [0,1], p > -1, \quad (1)$$
$$x(0) = 0, x'(1) = a.$$

has a positive solution on (0,1) for all positive

$$a < ((p+1)/2^p)^{1/(p-1)}.$$

Proof. Let $c > 0$ be a constant

$$c < ((p+1)/2^p)^{1/(p-1)}$$

and a be a fixed positive number with $a < c$. Consider the sequence

$$z_0(t) = 0,$$
$$z_n(t) = \int_0^t \tau(z_{n-1}(\tau) + a\tau)^p \, d\tau + t\int_t^1 (z_{n-1}(\tau) + a\tau)^p \, d\tau, n > 0. \quad (2)$$

We have

$$z_1'(t) = \int_t^1 (a\tau)^p \, d\tau < \frac{c^p}{p+1}(1 - t^{p+1}) \le c,$$
$$0 \le z_1(t) \le ct, \ldots$$
$$|z_n'(t)| = \int_t^1 (z_{n-1}(t) + a\tau)^p \, d\tau \le \int_t^1 (2c\tau)^p \, d\tau \quad (3)$$
$$= \frac{2^p c^p}{p+1}(1 - t^{p+1}) < c$$

and therefore

$$z_n(t) \le ct.$$

The sequence $\{z_n(t)\}_{n>0}$ is uniformly bounded and equiconvergent and it follows from Ascoli-Arzela lemma that $z_n(t) \to x_a(t)$ uniformly on [0,1] and

$$x_a(t) = \int_0^t \tau(x_a(\tau) + a\tau)^p \, d\tau + t\int_t^1 (x_a(\tau) + a\tau)^p \, d\tau, \quad (4)$$
$$x_a(t) + at = at + \int_0^t \tau(x_a(\tau) + a\tau)^p \, d\tau + t\int_t^1 (x_a(\tau) + a\tau)^p \, d\tau,$$
$$(x_a(\tau) + a\tau)'' + (x_a(\tau) + a\tau)^p = 0.$$

That is the function $y_a(t) = x_a(t) + at$ is the solution of the problem

$$x'' + x^p(t) = 0, \qquad t \in [0,1],$$
$$x(0) = 0, x'(1) = a.$$

Positivity of the solution for $t > 0$ easily follows from (2). Indeed

$$z_1(t) = \int_0^t \tau(a\tau)^p \, d\tau + t\int_t^1 (a\tau)^p \, d\tau > 0, \ t > 0 \quad (5)$$
$$z_2(t) = \int_0^t \tau(z_1(\tau) + a\tau)^p \, d\tau + t\int_t^1 (z_1(\tau) + a\tau)^p \, d\tau \ge z_1(t), \ldots$$

The proof is complete.

3. Application

It is interesting that the technique used in the proof of the theorem can be used to find the approximate solution of the problem

Example 1. Consider the problem

$$x'' + x^2(t) = 0, \qquad t \in [0,1],$$
$$x(0) = 0, x'(1) = 1/2.$$

The iteration (2) gives

$$z_0(t) = 0$$
$$z_1(t) = \int_0^t \tau\left(\frac{1}{2}\tau\right)^2 d\tau + t\int_t^1 \left(\frac{1}{2}\tau\right)^2 d\tau = \frac{1}{12}t - \frac{1}{48}t^4$$
$$z_2(t) = \int_0^t \tau\left(\frac{1}{12}\tau - \frac{1}{48}\tau^4 + \frac{1}{2}\tau\right)^2 d\tau + t\int_t^1 \left(\frac{1}{12}\tau - \frac{1}{48}\tau^4 + \frac{1}{2}\tau\right)^2 d\tau$$

$$= \frac{1}{207360} t(-t^9 + 120t^6 - 5880t^3 + 22690)$$

$$z_3(t) = \int_0^t \tau(\frac{1}{207360}\tau(-\tau^9 + 120\tau^6 - 5880\tau^3 + 22690) + \frac{1}{2}\tau)^2 \, d\tau$$

$$+ \int_t^1 (\frac{1}{207360}\tau(-\tau^9 + 120\tau^6 - 5880\tau^3 + 22690) + \frac{1}{2}\tau)^2 \, d\tau$$

$$= -\frac{1}{19865154355200} t^{22} + \frac{1}{61272391680} t^{19} - \frac{109}{42998169600} t^{16}$$

$$+ \frac{83197}{335385722880} t^{13} - \frac{27043}{1612431360} t^{10} + \frac{88459}{107495424} t^7$$

$$- \frac{159696769}{5159780352} t^4 + \frac{2134656287}{18059231232} t.$$

The table below demonstrates that even three term iteration gives a good approximate solution of the problem.

Tab. 1. Some numerical values of the problem presented in Example 1.

t	Approx. solution $x(t) \approx z_3(t) + (1/2)t$	Error in the solution
0	0	0
0.1	0.0618	$1.\,077464483\,6472 \times 10^{-4}$
0.2	0.123591	$4.\,299497827\,5028 \times 10^{-4}$
0.3	0.18521	$9.\,610806067\,4743 \times 10^{-4}$
0.4	0.24649	$1.\,686908421\,4271 \times 10^{-3}$
0.5	0.30717	$2.\,580633882\,0972 \times 10^{-3}$
0.6	0.36693	$3.\,599871361\,6217 \times 10^{-3}$
0.7	0.425378	$4.\,685036406\,9459 \times 10^{-3}$
0.8	0.482056	$5.\,759734158\,9714 \times 10^{-3}$
0.9	0.53646	$6.\,733673055\,2093 \times 10^{-3}$
1.0	0.58806	$7.\,508412070\,9118 \times 10^{-3}$

From Table 1, it can be seen clearly that the error in the solution is negligible. Moreover, this error can be reduced more and more by considering more terms in the iteration (2).

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BLOW UP OF SOLUTIONS FOR A TIMOSHENKO EQUATION WITH DAMPING TERMS

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Abstract: In this work, we studied the following equation

$$u_{tt}+\triangle^2 u-M\left(\|\nabla u\|^2\right)\triangle u-\triangle u_t+u_t=|u|^{q-1}u$$

regard to initial and Dirichlet boundary condition. We show that the blow up of solutions with positive and negative initial energy.

Keywords: Timoshenko equation, Blow up, Damping term.

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1 Introduction

In this work, we consider the following Timoshenko equation

$$\begin{cases} u_{tt}+\triangle^2 u-M\left(\|\nabla u\|^2\right)\triangle u-\triangle u_t+u_t=|u|^{q-1}u, & (x,t)\in\Omega\times(0,T), \\ u(x,0)=u_0(x),\ u_t(x,0)=u_1(x), & x\in\Omega, \\ u(x,t)=\frac{\partial}{\partial\nu}u(x,t)=0, & x\in\partial\Omega, \end{cases} \tag{1}$$

where Ω is a bounded domain of R^n having a smooth boundary $\partial\Omega$. Also $q\geq 1$ is real numbers, outer normal is denoted by ν and $M(s)=1+s^{\gamma},\ \gamma\geq 1$.

In the event of $M(s)=1$, without fourth order term $(\triangle^2 u)$ and strong damping term $(-\triangle u_t)$ the equation (1) can be recorded in the following form

$$u_{tt}-\triangle u+u_t=|u|^{q-1}u. \tag{2}$$

Georgiev and Todorova, Levine, Messaoudi, Vitillaro made further efforts to get the existence and blow up in finite time of solutions for (2).

In the event of $M(s) = 0$ and absent the strong damping term the equation (1) can be typed in the following form

$$u_{tt} + \triangle^2 u + u_t = |u|^{q-1} u. \tag{3}$$

Messaoudi [11] researched the local existence and studied blow up of the solution to the equation (3). Wu and Tsai [16] got global existence and made researches about blow up of the solution of the problem (3). Then, blow up of the solution for the problem (3) with positive initial energy was studied by Chen and Zhou [2] .

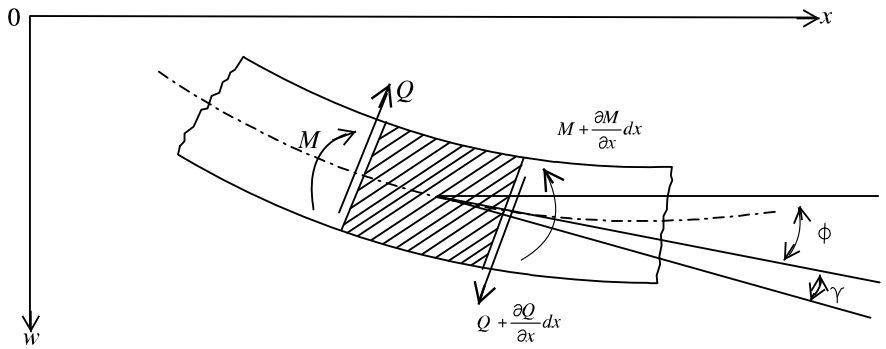
The problem (1) was researched by Esquivel-Avila [4, 5], he demonstrated blow up, unboundedness, convergence and made researches for global attractor. Pişkin [12] researched the local and global existence, asymptotic behavior also studied about blow up of the solution. Later, Pişkin and Irkıl [13] investigated blow up of the solutions (1) for positive initial energy.

In this paper, we show the blow up of solutions of the problem (1), for positive and negative initial energy.

This work is arranged as the following. In chapter 2, some lemmas and notations are given. In chapter 3, blow up of the solution is discussed.

1.1 Derivation of the Timoshenko equation

In this section, we show the derivation of the Timoshenko equation [3, 14].



In the foregoing figure, the bending moment is indicated by M and shearing force is indicated by Q. Also ϕ is the angle of bending and γ is the angle of shearing. Deflection is stated by W.

For a great number of minuscule deflections

$$\frac{\partial W}{\partial x} = \phi + \gamma \tag{4}$$

and by elementary beam theory

$$\begin{cases} M = -EI\frac{\partial \phi}{\partial x}, \\ Q = kAG\gamma. \end{cases} \tag{5}$$

Here, flexural rigidity is denoted by EI; k is a constant related to the form of cross-section of a beam; A is field of cross-section and modulus of rigidity is denoted by G.

The movements equations are:

The rotations equation is

$$-\frac{\partial M}{\partial x}dx + Qdx = \rho I \frac{\partial^2 \phi}{\partial t^2}dx. \tag{6}$$

Here, the density of the material is ρ.

In the direction of W, the equation for translation is-

$$\frac{\partial Q}{\partial x}dx = \rho A \frac{\partial^2 W}{\partial t^2}dx. \tag{7}$$

In equation (5), if the account of Q is substituted into equations (6) and (7), we get

$$-\frac{\partial M}{\partial x} + kAG\gamma = \rho I \frac{\partial^2 \phi}{\partial t^2}, \tag{8}$$

$$\frac{\partial \left(kAG\gamma\right)}{\partial x} = \rho A \frac{\partial^2 W}{\partial t^2}. \tag{9}$$

Substituting for

$$\gamma = \frac{\partial W}{\partial x} - \phi$$

in the equation (4) and

$$M = -EI\frac{\partial \phi}{\partial x}$$

in the equation (5) into equations (8) and (9), we attain

$$EI\frac{\partial^2 \phi}{\partial x^2} + kAG\left(\frac{\partial W}{\partial x} - \phi\right) - \rho I \frac{\partial^2 \phi}{\partial t^2} = 0, \tag{10}$$

$$\rho A \frac{\partial^2 W}{\partial t^2} - kAG\left(\frac{\partial^2 W}{\partial x^2} - \frac{\partial \phi}{\partial x}\right) = 0. \tag{11}$$

To eliminate ϕ from equations (10) and (11), we rearrange (12) to read

$$\frac{\partial \phi}{\partial x} = -\frac{\rho A}{kAG}\frac{\partial^2 W}{\partial t^2} + \frac{\partial^2 W}{\partial x^2}.$$

Now differentiating equation (10) accordinly to x and substituting for $\frac{\partial \phi}{\partial x}$ we attain

$$\begin{aligned} & EI\frac{\partial^2}{\partial x^2}\left[-\frac{\rho A}{kAG}\frac{\partial^2 W}{\partial t^2} + \frac{\partial^2 W}{\partial x^2}\right] \\ & +kAG\left[\frac{\partial^2 W}{\partial x^2} + \frac{\rho A}{kAG}\frac{\partial^2 W}{\partial t^2} - \frac{\partial^2 W}{\partial x^2}\right] \\ & -\rho I\frac{\partial^2}{\partial t^2}\left[-\frac{\rho A}{kAG}\frac{\partial^2 W}{\partial t^2} + \frac{\partial^2 W}{\partial x^2}\right] \\ = \; & 0. \end{aligned}$$

Simplifying the above expression we obtain

$$-\frac{EI\rho}{kG}\frac{\partial^4 W}{\partial x^2\partial t^2}+EI\frac{\partial^4 W}{\partial x^4}+\rho A\frac{\partial^2 W}{\partial t^2}+\frac{\rho^2 I}{kG}\frac{\partial^4 W}{\partial t^4}-\rho I\frac{\partial^4 W}{\partial x^2\partial t^2}=0,$$

therefore

$$EI\frac{\partial^4 W}{\partial x^4}-\rho I\left(1+\frac{E}{kG}\right)\frac{\partial^4 W}{\partial x^2\partial t^2}+\rho A\frac{\partial^2 W}{\partial t^2}+\frac{\rho^2 I}{kG}\frac{\partial^4 W}{\partial t^4}=0. \tag{12}$$

This equation is termed the "Timoshenko equation".

Rotatory inertia is symbolized by

$$-\rho I\frac{\partial^4 W}{\partial x^2\partial t^2}$$

in equation (12) and amendment related to shear by

$$-\frac{\rho IE}{kG}\frac{\partial^4 W}{\partial x^2\partial t^2}+\frac{\rho^2 I}{kG}\frac{\partial^4 W}{\partial t^4}.$$

The Euler's equation (13) is got from the Timoshenko equation by sifting the amendments related to both shear and rotatory inertia.

$$EI\frac{\partial^4 W}{\partial x^4}+\rho A\frac{\partial^2 W}{\partial t^2}=0. \tag{13}$$

The Timoshenko beam theory can be thought like a system, such as (10) and (11) or in the one form, as equation (12).

2 Preliminaries

In this chapter, we should show some assumptions and lemmas which will be taken advantage of. Where $\|.\|$ and $\|.\|_p$ indicate the usual $L^2(\Omega)$ norm and $L^p(\Omega)$ norm, in turn.

Lemma 1 *(Sobolev-Poincare inequality) [1]. Let p be a number with $2\leq p<\infty$ $(n=1,2)$ or $2\leq p\leq\frac{2n}{n-2}$ $(n\geq 3)$, and $C_*=C_*(\Omega,\ p)$ is a constant, such that*

$$\|u\|_p\leq C_*\|\nabla u\| \ \text{ for } u\in H_0^1(\Omega).$$

We identify the energy function as follows

$$\begin{aligned}E(t) &= \frac{1}{2}\|u_t\|^2+\frac{1}{2}\left(\|\nabla u\|^2+\|\Delta u\|^2\right)\\ &\quad+\frac{1}{2(\gamma+1)}\|\nabla u\|^{2(\gamma+1)}-\frac{1}{q+1}\|u\|_{q+1}^{q+1}.\end{aligned} \tag{14}$$

Lemma 2 *$E(t)$ is a nonincreasing function also $t\geq 0$ and*

$$E'(t)=-\|u_t\|^2-\|\nabla u_t\|^2\leq 0. \tag{15}$$

Proof. If we multiply the equation of (1) by u_t and integrate over Ω, use integrating by parts, we attain

$$E(t) - E(0) = -\int_0^t \left(\|u_\tau\|^2 + \|\nabla u_\tau\|^2 \right) d\tau \text{ for } t \geq 0. \tag{16}$$

■

Also, we remark the local existence theorem of problem (1), the proof of it can be present in [12].

Theorem 3 *(Local existence). Supposing that* $(u_0, u_1) \in H_0^2(\Omega) \times L^2(\Omega)$ *ensures, after there is an only solution* u *of (1) satisfying*

$$u \in C\left([0,T); H_0^2(\Omega)\right),$$

$$u_t \in C\left([0,T); L^2(\Omega)\right) \cap L^{p+1}(\Omega \times (0,T)).$$

Furthermore, at a minimum one of the following expressions holds:

(i) $T = \infty$,

(ii) $\|u_t\|^2 + \|\triangle u\|^2 \longrightarrow \infty$ *as* $t \longrightarrow T^-$.

3 Blow up of solutions

In this chapter, we work away the blow up of the solution for the problem (1). We should denote the following two lemmas,which will be taken advantage of then.

Lemma 4 *[9]. Let* $\delta > 0$ *and* $B(t) \in C^2(0,\infty)$ *be a nonnegative function satisfying*

$$B''(t) - 4(\delta+1)B'(t) + 4(\delta+1)B(t) \geq 0. \tag{17}$$

If

$$B'(0) > r_2 B(0) + K_0, \tag{18}$$

with $r_2 = 2(\delta+1) - 2\sqrt{(\delta+1)\delta}$, *then* $B'(t) > K_0$ *for* $t > 0$,*here* K_0 *is a constant.*

Lemma 5 *[9]. If* $H(t)$ *is a nonincreasing function on* $[t_0,\infty)$ *and satisfies the differential inequality*

$$\left[H'(t)\right]^2 \geq a + b\left[H(t)\right]^{2+\frac{1}{\delta}}, \text{ for } t \geq t_0, \tag{19}$$

where $a > 0$, $b \in R$, *then there exists a finite time* T^* *such that*

$$\lim_{t \longrightarrow T^{*-}} H(t) = 0.$$

Upper bounds for T^* are estimated as follows:

(i) If $b<0$ and $H(t_0)<\min\left\{1,\sqrt{-\frac{a}{b}}\right\}$ then

$$T^*\leq t_0+\frac{1}{\sqrt{-b}}\ln\frac{\sqrt{-\frac{a}{b}}}{\sqrt{-\frac{a}{b}}-H(t_0)}.$$

(ii) If $b=0$, then

$$T^*\leq t_0+\frac{H(t_0)}{\sqrt{a}}.$$

(iii) If $b>0$, then

$$T^*\leq\frac{H(t_0)}{\sqrt{a}}\ \text{or}\ T^*\leq t_0+2^{\frac{3\delta+1}{2\delta}}\frac{\delta c}{\sqrt{a}}\left[1-(1+cH(t_0))^{-\frac{1}{2\delta}}\right],$$

where $c=\left(\frac{a}{b}\right)^{\frac{\delta}{2\delta+1}}$.

Definition 6 *A solution u of (1) is termed blow up if there is a finite time T^* such that*

$$\lim_{t\longrightarrow T^*-}\left[\int_\Omega u^2dx+\int_0^t\int_\Omega\left(u^2+|\nabla u|^2\right)dxd\tau\right]=\infty. \tag{20}$$

Let

$$a(t)=\int_\Omega u^2dx+\int_0^t\int_\Omega\left(u^2+|\nabla u|^2\right)dxd\tau,\ \text{for}\ t\geq 0. \tag{21}$$

Lemma 7 *Assume $\frac{q-1}{4}\geq\delta\geq\frac{\gamma}{2}$, and that $\gamma\geq 0$, then we have*

$$a''(t)\geq 4(\delta+1)\int_\Omega u_t^2dx-4(2\delta+1)E(0)+4(2\delta+1)\int_0^t\left(\|u_\tau\|^2+\|\nabla u_\tau\|^2\right)d\tau. \tag{22}$$

Proof. *By differentiating (21) according to t, we have*

$$a'(t)=2\int_\Omega uu_tdx+\|u\|^2+\|\nabla u\|^2, \tag{23}$$

$$\begin{aligned}a''(t)&=2\int_\Omega u_t^2dx+2\int_\Omega uu_{tt}dx+2\int_\Omega uu_tdx+2\int_\Omega\nabla u\nabla u_tdx\\&=2\left(\|u_t\|^2+\|u\|_{q+1}^{q+1}\right)-2\left(\|\nabla u\|^2+\|\nabla u\|^{2(\gamma+1)}+\|\Delta u\|^2\right).\end{aligned} \tag{24}$$

Then from (1) and (24), we have

$$\begin{aligned}a''(t)&=4(\delta+1)\int_\Omega u_t^2dx-4(2\delta+1)E(0)\\&\quad+4\delta\left(\|\nabla u\|^2+\|\Delta u\|^2\right)+\left(\frac{4\delta+2}{\gamma+1}-2\right)\|\nabla u\|^{2(\gamma+1)}\\&\quad+\left(2-\frac{4(2\delta+1)}{q+1}\right)\|u\|_{q+1}^{q+1}+4(2\delta+1)\int_0^t\left(\|u_\tau\|^2+\|\nabla u_\tau\|^2\right)d\tau.\end{aligned}$$

Since $\frac{q-1}{4}\geq\delta\geq\frac{\gamma}{2}$, we obtain (22). ■

Lemma 8 *Assume* $\frac{q-1}{4} \geq \delta \geq \frac{\gamma}{2}$, $\gamma \geq 0$ *and one of the following expressions are satisfied*

(i) $E(0) < 0$ *and* $\int_\Omega u_0 u_1 dx > 0$,

(ii) $E(0) = 0$ *and* $\int_\Omega u_0 u_1 dx > 0$,

(iii) $E(0) > 0$ *and*

$$a'(0) > r_2 \left[a(0) + \frac{K_1}{4(\delta+1)} \right] + \|u_0\|^2 + \|\nabla u_0\|^2 \tag{25}$$

holds.

Then $a'(t) > \|u_0\|^2 + \|\nabla u_0\|^2$ *for* $t > t^*$, *where* $t_0 = t^*$ *is given by (26) in case (i) and* $t_0 = 0$ *in cases (ii) and (iii).*

Where K_1 *and* t^* *are defined in (30) and (26), in turn.*

Proof. (i) If $E(0) < 0$, then by (22), we attain

$$a'(t) \geq 2\int_\Omega u_0 u_1 dx + \|u_0\|^2 + \|\nabla u_0\|^2 - 4(2\delta+1)E(0)t, \quad t \geq 0$$

Thereby we obtain $a'(t) > \|u_0\|^2 + \|\nabla u_0\|^2$ for $t > t^*$, where

$$t^* = \max\left\{ \frac{a'(0) - \left(\|u_0\|^2 + \|\nabla u_0\|^2 \right)}{4(2\delta+1)E(0)},\ 0 \right\}. \tag{26}$$

(ii) If $E(0) = 0$ and $\int_\Omega u_0 u_1 dx > 0$, then $a''(t) \geq 0$ for $t \geq 0$. We have $a'(t) > \|u_0\|^2 + \|\nabla u_0\|^2$, $t \geq 0$.

(iii) If $E(0) > 0$, firstly, we write down that

$$2\int_0^t \int_\Omega u u_t dx d\tau = \|u\|^2 - \|u_0\|^2. \tag{27}$$

Utilising Hölder inequality and Young inequality, we obtain

$$\|u\|^2 \leq \|u_0\|^2 + \int_0^t \|u\|^2 d\tau + \int_0^t \|u_\tau\|^2 d\tau \tag{28}$$

From (21), (23) and (28), we attain

$$a'(t) \leq a(t) + \|u_0\|^2 + \|u_t\|^2 + \int_0^t \int_\Omega \left(u_\tau^2 + |\nabla u|^2 \right) dx d\tau. \tag{29}$$

Hence, by (22) and (29), we get

$$a''(t) - 4(\delta+1)a'(t) + 4(\delta+1)a(t) + K_1 \geq 0,$$

where

$$\begin{aligned} K_1 &= 4(2\delta+1)E(0) + 4(\delta+1)\int_\Omega u_0^2 dx \\ &\quad + 4(\delta+1)\int_\Omega |\nabla u|^2 dx - 4\delta \int_0^t \left(\|u_\tau\|^2 + \|\nabla u_\tau\|^2 \right) d\tau \end{aligned} \tag{30}$$

Let

$$b(t) = a(t) + \frac{K_1}{4(\delta+1)}, \quad t > 0.$$

After $b(t)$ provides Lemma 4. As a result, we obtain by (25) $a'(t) > \|u_0\|^2 + \|\nabla u_0\|^2$, $t > 0$, where r_2 is given in Lemma 4. ■

Theorem 9 *Assume* $\frac{q-1}{4} \geq \delta \geq \frac{\gamma}{2}$, $\gamma \geq 0$ *and one of the following expressions are satisfied*

(i) $E(0) < 0$ *and* $\int_\Omega u_0 u_1 dx > 0$,

(ii) $E(0) = 0$ *and* $\int_\Omega u_0 u_1 dx > 0$,

(iii) $0 < E(0) < \frac{\left(a'(t_0) - \left(\|u_0\|^2 + \|\nabla u_0\|^2\right)\right)^2}{8\left[a(t_0) + (T_1 - t_0)\left(\|u_0\|^2 + \|\nabla u_0\|^2\right)\right]}$ *and (25) holds.*

After the solution u blow up in finite time T^* *in the case of (30). In case (i),*

$$T^* \leq t_0 - \frac{H(t_0)}{H'(t_0)}. \tag{31}$$

Moreover, if $H(t_0) < \min\left\{1, \sqrt{-\frac{a}{b}}\right\}$, *we get*

$$T^* \leq t_0 + \frac{1}{\sqrt{-b}} \ln \frac{\sqrt{-\frac{a}{b}}}{\sqrt{-\frac{a}{b}} - H(t_0)}, \tag{32}$$

where

$$a = \delta^2 H^{2+\frac{2}{\delta}}(t_0) \left[\left(a'(t_0) - \|u_0\|^2\right)^2 - 8E(0) H^{-\frac{1}{\delta}}(t_0)\right] > 0, \tag{33}$$

$$b = 8\delta^2 E(0). \tag{34}$$

In case (ii),

$$T^* \leq t_0 - \frac{H(t_0)}{H'(t_0)}. \tag{35}$$

In case (iii),

$$T^* \leq \frac{H(t_0)}{\sqrt{a}} \text{ or } T^* \leq t_0 + 2^{\frac{3\delta+1}{2\delta}} \left(\frac{a}{b}\right)^{2+\frac{1}{\delta}} \frac{\delta}{\sqrt{a}} \left\{1 - \left[1 + \left(\frac{a}{b}\right)^{2+\frac{1}{\delta}} H(t_0)\right]^{-\frac{1}{2\delta}}\right\}, \tag{36}$$

where a and b are given (33), (34).

Proof. Let

$$H(t) = \left[a(t) + (T_1 - t)\left(\|u_0\|^2 + \|\nabla u_0\|^2\right)\right]^{-\delta}, \text{ for } t \in [0, T_1], \tag{37}$$

where $T_1 > 0$ is a specific constant that will be indicated then. Later, we obtain

$$\begin{aligned} H'(t) &= -\delta\left[a(t) + (T_1 - t)\left(\|u_0\|^2 + \|\nabla u_0\|^2\right)\right]^{-\delta-1}\left[a'(t) - \left(\|u_0\|^2 + \|\nabla u_0\|^2\right)\right] \\ &= -\delta H^{1+\frac{1}{\delta}}(t)\left[a'(t) - \left(\|u_0\|^2 + \|\nabla u_0\|^2\right)\right], \end{aligned} \tag{38}$$

$$\begin{aligned} H''(t) &= -\delta H^{1+\frac{2}{\delta}}(t) a''(t)\left[a(t) + (T_1 - t)\left(\|u_0\|^2 + \|\nabla u_0\|^2\right)\right] \\ &\quad + \delta H^{1+\frac{2}{\delta}}(t)(1+\delta)\left[a'(t) - \left(\|u_0\|^2 + \|\nabla u_0\|^2\right)\right]^2. \end{aligned} \tag{39}$$

and

$$H''(t) = -\delta H^{1+\frac{2}{\delta}}(t) V(t), \tag{40}$$

where

$$V(t) = a''(t)\left[a(t) + (T_1 - t)\left(\|u_0\|^2 + \|\nabla u_0\|^2\right)\right] - (1+\delta)\left[a'(t) - \left(\|u_0\|^2 + \|\nabla u_0\|^2\right)\right]^2. \tag{41}$$

For simplicity of calculation, we define

$$\begin{aligned} P_u &= \textstyle\int_\Omega u^2 dx, & R_u &= \textstyle\int_\Omega u_t^2 dx, \\ Q_u &= \textstyle\int_0^t \|u\|^2 dt, & S_u &= \textstyle\int_0^t \|u_t\|^2 dt, \\ M_u &= \textstyle\int_0^t \|\nabla u\|^2 d\tau, & N_u &= \textstyle\int_0^t \|\nabla u_\tau\|^2 d\tau. \end{aligned}$$

From (23), (27) and Hölder inequality, we get

$$\begin{aligned} a'(t) &= 2\int_\Omega u u_t dx + \|u_0\|^2 + \|\nabla u\|^2 + 2\int_0^t \int_\Omega u u_t dx dt \\ &\leq 2\left(\sqrt{R_u P_u} + \sqrt{Q_u S_u}\right) + \|u_0\|^2 + \|\nabla u\|^2. \end{aligned} \tag{42}$$

If case (i) or (ii) holds, from (22) we get

$$a''(t) \geq (-4 - 8\delta) E(0) + 4(1+\delta)(R_u + S_u + N_u). \tag{43}$$

Thus, from (41)-(43) and (37), we attain

$$\begin{aligned} V(t) \geq\ & \left[(-4-8\delta) E(0) + 4(1+\delta)(R_u + S_u + N_u)\right] H^{-\frac{1}{\delta}}(t) \\ & -4(1+\delta)\left(\sqrt{R_u P_u} + \sqrt{Q_u S_u} + \sqrt{M_u N_u}\right)^2. \end{aligned}$$

From (21),

$$\begin{aligned} a(t) &= \int_\Omega u^2 dx + \int_0^t \int_\Omega \left(u^2 + |\nabla u|^2\right) dx d\tau \\ &= P_u + Q_u + M_u \end{aligned}$$

and (37), we get

$$V(t) \geq (-4-8\delta) E(0) H^{-\frac{1}{\delta}}(t) + 4(1+\delta)\left[(R_u + S_u + N_u)(T_1 - t)\left(\|u_0\|^2 + \|\nabla u_0\|^2\right) + \Theta(t)\right],$$

where

$$\Theta(t) = (R_u + S_u + N_u)(P_u + Q_u + M_u) - \left(\sqrt{R_u P_u} + \sqrt{Q_u S_u} + \sqrt{M_u N_u}\right)^2.$$

Utilising the Schwarz inequality, and $\Theta(t)$ being nonnegative, we get

$$V(t) \geq (-4-8\delta) E(0) H^{-\frac{1}{\delta}}(t), \ t \geq t_0. \tag{44}$$

Thus, from (40) and (44), we obtain

$$H''(t) \leq 4\delta(1+2\delta) E(0) H^{1+\frac{1}{\delta}}(t), \ t \geq t_0. \tag{45}$$

From Lemma 8, we recognise that $H'(t) < 0$ for $t \geq t_0$. Multiplying (45) by $H'(t)$ and integrating it from t_0 to t, we obtain

$$H'^2(t) \geq a + bH^{2+\frac{1}{\delta}}(t)$$

for $t \geq t_0$, we can see a, b are described in (33) and (34) in turn.

If case (iii) holds, similar to the steps of case (i), we obtain $a > 0$ if and only if

$$E(0) < \frac{\left(a'(t_0) - \left(\|u_0\|^2 + \|\nabla u_0\|^2\right)\right)^2}{8\left[a(t_0) + (T_1 - t_0)\left(\|u_0\|^2 + \|\nabla u_0\|^2\right)\right]}.$$

After, from Lemma 5, there is a finite time T^* such that $\lim_{t \longrightarrow T^{*-}} H(t) = 0$ and upper bound of T^* is estimated for the sign of $E(0)$. This implies that (20) provides. ■

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THE EFFECT OF THE USING CORN FLOUR LEVEL AND ADDITIVE TYPE ON QUALITY OF CORN BREAD

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Abstract:*The effects of different levels of corn flours and additives on traditionally produced (in the Black Sea Region) corn bread's quality parameters were studied; the breads containing different levels of corn flour (0%, 10%, 20%, 30%, 40%, 50%, 75%, 100%) in flour formulation were produced as two different additives type [(10% whole egg, 10% butter and 5% yogurt combination and without addition (control)]. As a result, the additive, one of the main variation sources, was found to have a high very significant (p≤0.01) effects on mass, volume, specific volume, L* and a* color values of crumb, and crust of bread and the moisture values of crumb (0, 1 and 2. days). Besides, the same variation source was also found to have a high very significant (p≤0.01) effects on sensorial appearance, porosity, texture, volume, color of crust, color of crumb, chewiness, taste, aroma, overall acceptability, and hardness, cohesiveness, elasticity, chewiness, and gumminess parameters measured on 0, 1 and 2 days. parameters. Also corn flour variant had a highly significant (p≤0.01) effects on the mass, volume, specific volume, L* and a* color values of crust, a*color value of crumb, the moisture values of crumb and sensorial appearance, porosity, texture, volume, color of crust, color of crumb, chewiness, aroma, and overall acceptability, hardness (0, 1, and 2. day), cohesiveness (day 1), elasticity (day 0), chewiness (day 0, and 2), gumminess (day 0, 1, and 2) and significant (p≤0.05) effects on cohesiveness (day 0, and 2) and cohesiveness (day 2) parameters. Also analyze of variance indicated that the interaction between addition and amount of corn flour was significantly (p≤0.01) in most traits.*

Key words*: Corn flour, corn bread, textural properties, sensory analysis*

1. Introduction

According to the Turkish food codex bread and bread varieties (Communiqué No: 2012/2). Cornbread; according to the technique at least 20% corn flour or cornmeal is added to the wheat flour and the bread is produced [1]. Grains have high energy content depending on the amount of carbohydrate. In addition to this, the satisfaction of the grain products is another important feature. They are neutral in terms of taste and aroma, and with this feature, they have become food items that

can be renewed without being tired of their age [2]. Corn is an important plant which is used both in human nutrition and in the animal feed ration. In the world, most of it is are used as animal feed. It can also be used in making bread, popcorn, cornflakes, corn oil and corn syrup. Starch and oil are very important types of corn grain. From 100 kg of corn grain yield, 77 kg of starch, 2 kg of sugar, 9 kg of protein, 5 kg of oil and 7 kg of other ingredients may be obtained [3]. [4], investigated the effect of wheat, wild oat, corn and pea husk on bread qualities and determined the chemical composition. It has been found that the ratio of total dietary fiber (90.3%), neutral detergent fiber (Fibrous materials consisting of hemicellulose, cellulose, lignin, cutin and silicon, which are insoluble in neutral detergent solutions) (87.6%) and hemicellulose (65.2%) is higher in corn cobs compared to other dietary fiber sources and wheat kernels cobs [5].

The gluten protein of the wheat grain endosperm, which gives a characteristic structure to the dough made from wheat flour cannot be found in corn grain. Gluten is responsible for viscoelastic properties of dough. Occurs a strong dough structure in resulting interaction of gluten with each other [6]. The increase in viscoelastic properties of the wheat flour paste is attributed to the gluten content of the flour [7]. The higher the gluten content of the wheat flour, the higher the viscoelastic properties of the dough will be obtained [8]. When the bread is made from corn alone a strong dough structure cannot be formed because corn flour does not have this protein. The main storage protein of corn is the zein constitutes 45-50% of the protein in maize. Due to negative nitrogen balance and low solubility in water, zein insulation cannot be used directly for human consumption [9].

The properties of the inner part of the bread being formed at the desired quality, the effects of improving the properties of the inner part of the oil, and during their doughing and processing; depends on the solid fractions that can be found solid at the paste temperature [10]. The shortening, especially the dough, must be sufficiently solid during the final fermentation that the inclusion of solid crystalline fractions is necessary to have a positive effect on bread characteristics [11]. The use of yogurt in making bread positively affects the rheological properties of the dough, the volume of bread size, specific volume size, crust color, bread texture and coloring [12]. [13], they investigated the effect of dried egg yolks and phospholipase A2 on the rheological properties of wheat dough were investigated. With the addition of eggs, the dough softness decreased while the farinograph increased the dough development time and the dough stability. In the combination addition of egg yolk and phospholipase A2 was added, it was found to be significantly more effective than the formulation in which egg yolk was not included. When phospholipase A2 was added to the yolk of the fried egg, the gluten network structure of the dough increased.

The aim of this study, the effects of different levels of corn flours and additives types on corn bread's quality parameters.

2. Material and Methods

2.1.Materials

Corn flour was obtained from Trabzon. In this study wheat flour was used as flour. In addition, eggs, butter, yoghurt, salt and wet yeast were also supplied from the market, also the water was obtained from Atatürk University drinking water network.

2.2.Method

Corn bread production

Bread were produced according to AACC-10/09 (1983) direct pastry process with and without additives in Grain Products Application Laboratories of Atatürk University Faculty of Agriculture Department of Food Engineering. In unadulterated formulations, 100 g of flour was added to 3% yeast, 1.5% salt and water detected in farinograph at the following ratios.; addition of water to the additive formulations at a rate determined in farinograph in 100 g flour based on 3% yeast, 1.5% salt, 5% yoghurt, 10% butter, 10% egg (as a whole) and Table 1.

Table 1. Water quantities % determined in farinograph of flours used in the experiment

Corn flour additive level (%)	Amount of water determined in farinograph (%)
0	60,0
10	56,5
20	54,5
30	53,0
40	50,0
50	48,0
75	Unidentified (%48)
100	Unidentified (%48)

The ingredients in the formulation were kneaded in the kneader for 5 minutes and then cut into 160 g masses and rounded off and then left for 30 minutes in the main fermentation chamber in a fermentation cabinet with a relative humidity of 75-80% and a temperature of 30°C. Ventilated doughs were left to rest at 75-80% relative humidity and 30 minutes at 30 ° C, after which they were placed in the trough. All the dough was incubated at 90% relative humidity and 30 minutes at 30 ° C for the final fermentation, followed by 25 minutes at 225°C.

2.3.Analyzes made on cornbread samples

Determination of the bread mass, size measurement, to determine the specific size of the bread [2] was based. Measurements of color intensity in the bread and its crumbs, crumb and crust determination of moisture content [14] were based. Sensory analysis was performed according to [15]. Determination of texture properties of the bread.

The method described by [16] for the texture analysis which has been modified. An SMS texture analyzer (Stable Micro System, model TA-XT. plus, England) was used in conjunction with a 75 mm diameter probe for texture analysis of the bread and the textural properties of the center of the bread under the following conditions were determined to be two parallels. After the bread were made, they were cooled for one 1 hours and then placed in polyethylene bags and stored at room temperature for 2 days. Initial measurements (day 0) were made for one hour after the bread was removed from the oven. At the end of the specified periods, the bread was cut into 2.5 cm thick slice in a special slicing cabinet and then cut into 2.5x2.5x2.5 cm size to center exactly the center of the bread.

The hardness, cohesiveness, elasticity and chewiness parameters which are closely related to the sensory properties were measured and the gumminess value was calculated [17].

2.4.Statistical analysis

In order to response of two different additives type [(10% whole egg, 10% butter and 5% yogurt combination and without addition (control)], eight different levels (0%, 10%, 20%, 30%, 40%, 50%, 75% and 100%) of corn flour the experiment was carried out as factorial experiment with completely

randomized design of two replications. Analysis of variances carried out by SPSS program (SPSS 1999). Duncan Multiple Comparison Test was used to measure the statistical differences between treatment methods and controls (P≤ 0.01) [18].

3. Results

3.1.Bread mass, volume and specific volume values of bread added to different levels of corn flour

In the present study analysis of variance (Table 2) indicated that there were significantly (P ≤ 0.01) affected by differences additive type, different levels of corn flour and their interaction based on the1st and 2nd recurrences of the bread mass, volume, and specific volume.

The results of mean comparison of mass, volume and specific volume for additive type showed that the highest mean were observed in additive with 135.12 (g), 476.56 (ml) and 3.52 (ml/g) respectively, whereas the lowest was in without additive with 133.74 (g), 355.31 (ml) and 2.66 (mL/g) respectively. Based on amount of corn flour application, the highest means of mass, volume and specific volume were obtained that %40 with 137.23 g, 0.00% with 603.75 ml and 0.00 (control) with 4.54 ml/g application respectively, whereas the lowest was observed in 100% amount of corn application with 130.17 g, 241.25 ml, and 1.86 mg/l respectively. The result exhibited that corn flour concentration application increased from 0.0 to 100.0%, volume and specific also increased (Table 2).

Analysis of variance displayed that there were significantly two-way interactions between additive type × amount of corn flour (P≤ 0.01) (Table 2). According to interaction effects of additive type and amount of corn flour, the highest mass, volume and specific in additive + %40 amount of corn flour (137.48 g), additive + %0.0 amount of corn (612.50 ml) and additive + %0.0 amount of corn (4.55 ml) respectively was achieved, but the lowest of traits above was obtained in additive + 100.0% amount of corn (129.79 g), without additive + 75.0% amount of corn (182.50) and without additive + 75.0% amount of corn (1.37%) respectively (Table 2).

Table 2. Effect of different additive types and amount of corn flour on mass, volume and specific volume in the corn bread.

Addition	Amount of corn flour (%)	Mass(g)	Volume (ml)	Specific volume (ml/g)
Additive	0.00	134.72 c[1]	612.50 a	4.55 a
	10.0	137.42 c	587.50 b	4.28 b
	20.0	134.75 c	540.00 c	4.01 c
	30.0	135.29 bc	535.00 c	3.96 c
	40.0	137.84 a	497.50 d	3.61 d
	50.0	137.62 ab	435.00 e	3.16 e
	75.0	133.55 c	322.50 f	2.42 f
	100.0	129.79 d	282.50 g	2.18 g
	Average	**135.12 a**	**476.56 a**	**3.52 a**
Without additive	0.00	131.52 cd	595.00 a	4.53 a
	10.0	132.17 c	527.50 b	3.99 b
	20.0	132.91 bc	410.00 c	3.09 c
	30.0	135.75 a	370.00 d	2.73 d
	40.0	136.62 a	312.50 e	2.29 e
	50.0	136.61 a	245.00 f	1.79 f
	75.0	133.82 b	182.50 g	1.37 h
	100.0	130.55 d	200.00 g	1.54 g
	Average	**133.74 b**	**355.31 b**	**2.66 b**

Average (amount of corn flour)	0.00	133.12 d	603.75 a	4.54 a
	10.0	134.80 bc	557.50 b	4.13 b
	20.0	133.83 cd	475.00 c	3.55 c
	30.0	135.52 b	452.50 d	3.34 d
	40.0	137.23 a	405.00 e	2.95 e
	50.0	137.11 a	340.00 f	2.48 f
	75.0	133.68 cd	252.50 g	1.89 g
	100.0	130.17 e	241.25 h	1.86 g
F value (additive type) A		**31.05**[**2]	**1252.00**[**]	**1366.00****
F value (Amount of corn flour) A		**22.24**[**]	**2090.00**[**]	**2056.00****
F value (A × A)		**6.132**[**]	**68.00**[**]	**86.00****

[1] The averages shown by the same letter are statistically different from each other ($P \leq 0.05$).

[2]**: Significant at $P \leq 0.01$, *: Significant at $P \leq 0.05$, ns: Non-significant at $P \geq 0.05$.

3.2.Crust color and inner color in the cornbread to different levels of corn flour and addition type

According to Table 3 there were significantly ($P \leq 0.01$) affected by additive type, different levels of corn flour and their interaction based on crust color (such as; L, a and b except of amount of corn flour in b parameters) and Inner (such as; a except of amount of corn flour in L parameters and additive type, amount of corn flour and their interaction).

The results of mean comparison of crust and inner color (L, a and b) for additive type presented that the highest means were observed in without additive with 69.51, additive with 13.73, without additive with 32.05 respectively, whereas the lowest parameters were in additive with 51.95, without additive with 6.65 and additive with 31.55 in crust color respectively, while in inner color (L and a) the highest means were observed in additive with 64.77 in L parameters and without additive with -0.23 respectively, also the lowest was revolved that without additive with 64.56 in L parameters and a parameters with -1.26 in additive application.Based on amount of corn flour application, the highest means of crust and inner color (L, a and b) were achieved that the crust color in L parameters in %100 with 72.38, a parameters in 0.00% with 13.82 and b parameters in 100.0% with 49.64 respectively, while in inner color in L, a and b parameters at 100.0% consuming of corn flour with 68.45, 1.13 and 45.48 respectively.Whereas the lowest above parameters was observed in 0.00% amount of corn with 55.10 in L parameters in crust color, 100.0% amount of corn with 3.18 in a parameter in crust color and 0.00% amount of corn with 27.44 in b parameters in crust color, whereas the lowest parameters in inner color in L (20.0% with 62.60), a (%30 with -1.70) b (0.0% with 15.69) was obtained (Table 3).

Analysis of variance showed that there were significantly two-way interactions between additive type × amount of corn flour ($P \leq 0.01$) in all parameters except b in inner color (Table 3). According to interaction effects of additive type and amount of corn flour, the highest value in L parameters in crust color was obtained in without additive + 100.0% (77.11) amount of corn flour but the lowest was achieved in additive + 40.0% (43.24%) application. While in a parameter, the highest value was accomplished in additive + 0.00% (17.67) application but the lowest was in without additive + 75.0% (1.91) application. As well as, the highest value in b parameter was realized in additive + 100.0% (50.51), but the lowest was obtained in additive + 40.0% application. Also according to Table 3, the highest value in L parameters in inner color was obtained in without additive + 100.0% (70.59) amount of corn flour but the lowest it was achieving in with additive + 00.0% (60.53%) application.

While, in a parameter the highest value was obtained in additive + 100.0% (0.56) application but the lowest was in additive + 30% (-2.13) application (Table 3).

Table 3. Effect of different additive types and amount of corn flour on the crust and inner color in the corn bread.

Addition	Amount of corn flour	Crust			Inner		
		L^3	a^3	b^3	L	a	b
Additive	0.00	45.85 bc[1]	17.67 a	26.65 d	65.55	-1.56 bc	15.37
	10.0	45.58 bc	16.01 b	23.78 ef	64.54	-1.99 cd	19.54
	20.0	50.17 b	16.56 ab	28.92 c	64.53	-1.94 cd	23.70
	30.0	46.06 bc	16.33 b	25.00 e	64.39	-2.13 d	26.98
	40.0	43.24 c	14.67 c	22.40 f	64.31	-1.93 cd	29.61
	50.0	50.31 b	15.56 bc	28.97 c	64.17	-1.43 b	36.14
	75.0	66.71 a	8.67 d	46.16 b	64.35	0.30 a	43.09
	100.0	67.66 a	4.37 e	50.51 a	66.31	0.56 a	47.61
	Average	**51.95 b**	**13.73 a**	**31.55 b**	**64.77 a**	**-1.26 b**	**30.25**
Without additive	0.00	64.35 c	9.98 a	28.24 de	60.53 d	-0.99 c	16.02
	10.0	68.47 bc	9.08 a	24.51 f	60.99 d	-0.97 c	19.25
	20.0	66.61 c	8.78 a	27.47 e	60.67 d	-1.16 c	23.74
	30.0	67.49 bc	8.58 ab	28.08 de	66.72 b	-1.28 c	29.03
	40.0	67.89 bc	7.11 bc	29.65 cd	64.43 c	-0.96 c	32.17
	50.0	72.05 b	5.79 c	31.14 c	66.07 b	0.12 b	36.38
	75.0	72.08 b	1.91 d	38.56 b	66.47 b	1.73 a	41.57
	100.0	77.11 a	2.00 d	48.78 a	70.59 a	1.71 a	43.34
	Average	**69.51 a**	**6.65 b**	**32.05 a**	**64.56 b**	**-0.23 a**	**30.19**
Average (amount of corn flour)	0.00	55.10 c	13.82 a	27.44	63.04	-1.27 c	15.69
	10.0	57.02 c	12.54 b	24.14	62.76	-1.48 cd	19.40
	20.0	58.39 bc	12.67 b	28.19	62.60	-1.55 cd	23.72
	30.0	56.77 c	12.45 b	26.54	65.56	-1.70 d	28.00
	40.0	55.56 c	10.89 c	26.02	64.37	-1.44 cd	30.89
	50.0	61.18 b	10.67 c	30.06	65.12	-0.66 b	36.26
	75.0	69.40 a	5.29 d	42.36	65.41	1.01 a	42.33
	100.0	72.38 a	3.18 e	49.64	68.45	1.13 a	45.48
F value (additive type) A		**39.00****[2]	**165.00****	**471.05****	**11.37****	**179.69****	**190.59**^{ns}
F value (Amount of corn flour) A		**564.00****	**1115.00****	**2.89** ^{ns}	**0.27** ^{ns}	**285.10****	**0.016** ^{ns}
F value (A × A)		**10.00****	**12.00****	**26.28****	**9.05****	**3.57***	**1.92** ^{ns}

[1]The averages shown by the same letter are statistically different from each other ($P \leq 0.05$).

[2]**: Significant at $P \leq 0.01$, *: Significant at $P \leq 0.05$, ns: Non-significant at $P \geq 0.05$.

[3]L (light color-Dark color), a (+a: Red, -a: Green) and b (+yellow, -blue)

3.3.Moisture values in the cornbread to different levels of corn flour and addition type

Analysis of variance (Table 4) indicated that there were significantly ($P \leq 0.01$) affected by differences additive type, different levels of corn flour and their interaction based on the 0th, first and second moisture of the bread.

The results of mean comparison of 0th first and second moisture for additive type showed that the highest mean were observed in without additive with 42.73%, 38.23%, and 36.49% respectively, whereas the lowest were in additive with 35.98%, 31.43% and 29.79 respectively. Based on amount of corn flour application, the highest means of 0th, first and second moisture was obtained that 0.00% with 41.0%, 0.00% with 39.03% and 10.0% with 36.48% application respectively, whereas the lowest was detected in 100% amount of corn application with 37.73%, 32.35 and 30.35% respectively. The result displayed that corn flour concentration application increased from 0.0 to 100.0%, the 0st ,1st and 2nd moisture also decreased (Table 4).

Analysis of variance displayed that there were significantly two-way interactions between additive type × amount of corn flour (P≤ 0.01) (Table 2). According to interaction effects of additive type and amount of corn flour, the highest 0st ,1st and 2nd moisture value in without additive + %75.0 amount of corn flour (43.10%), without additive + %0.0 amount of corn (41.50%) and without additive + %10.0 amount of corn (38.40%) respectively was achieved, however the lowest of traits above was obtained in additive + 100.0% amount of corn (32.45), additive + 75.0% amount of corn (27.45%) and additive + 100.0% amount of corn (25.60) respectively (Table 4).

Table 4. Effect of different additive, without additive types and amount of corn flour on moisture in the corn bread.

Addition	**Amount of corn flour**	**Moisture (%)**		
		0th day	**1st day**	**2nd day**
Additive	0.00	39.75 a[1]	36.55 a	34.45 a
	10.0	39.25 b	34.15 b	34.55 a
	20.0	37.95 c	33.00 bc	29.50 b
	30.0	37.40 d	31.30 c	30.70 b
	40.0	35.00 e	31.95 c	30.70 b
	50.0	33.35 f	28.85 d	26.70 c
	75.0	32.65 g	27.45 d	26.10 c
	100.0	32.45 g	28.15 d	25.60 c
	Average	**35.98 b**	**31.43 b**	**29.79 b**
Without additive	0.00	42.25 a	41.50 a	37.75 a
	10.0	42.70 a	39.00 b	38.40 a
	20.0	42.65 a	38.40 b	37.55 ab
	30.0	42.85 a	37.25 b	37.00 ab
	40.0	42.45 a	37.85 b	35.85 abc
	50.0	42.85 a	37.05 b	34.30 c
	75.0	43.10 a	38.20 b	36.00 abc
	100.0	43.00 a	36.55 b	35.10 bc
	Average	**42.73 a**	**38.23 a**	**36.49 a**
Average (amount of corn flour)	0.00	41.00 a	39.03 a	36.10 a
	10.0	40.98 a	36.58 b	36.48 a
	20.0	40.30 b	35.70 bc	33.53 b
	30.0	40.13 b	34.28 cd	33.85 b
	40.0	38.73 c	34.90 c	33.28 b
	50.0	38.10 d	32.95 de	30.50 c
	75.0	37.88 d	32.83 de	31.05 c
	100.0	37.73 d	32.35 e	30.35 c
F value (additive type) A		2439.00**[2]	426.00**	389.00**
F value (Amount of corn flour) A		52.00**	23.00**	24.00**
F value (A × A)		67.00**	5.1.00**	6.60**

[1]The averages shown by the same letter are statistically different from each other (P ≤ 0.05).
[2]**: Significant at P ≤ 0.01, *: Significant at P ≤ 0.05, ns: Non-significant at P ≥ 0.05.

3.4.Sensory analyzes in the cornbread to different levels of corn flour and addition type

In the present study analysis of variance (Table 5) showed that there were significant (P ≤ 0.01) affected by differences additive type, different levels of corn flour and their interaction based on sensory analyzes characterizes of the bread.

The results of mean comparison sensory analyzes characterizes such as appearance, pore, texture, volume, shell color, ınner color, chewing, aroma, taste, general acceptability for additive type

displayed that the highest mean were observed in additive with 7.07, 6.99, 7.22, 6.66, 6.96, 7.05, 7.27, 7.63, 7.52 and 7.11 respectively, while the lowest was in without additive with 4.87, 4.88, 5.14, 4.33, 4.52, 5.35, 5.08, 5.83, 5.67 and 5.05 respectively at the above characterize. Based on amount of corn flour application, the highest means of analyzes characterizes such as appearance, pore, texture, volume, shell color, ınner color, chewing, general acceptability were detected that 0.00% to 7.91, 8.25, 8, 7.75, 7.32, 7.82, 8.07, 7.51 with respectively however at aroma (7.25) and taste (7.25) it was observed in 10.0%. The lowest appearance, pore, texture, volume, shell color, ınner color, chewing, aroma, taste, general acceptability was detected in 100% amount of corn application with 2.75, 2.69, 3.94, 2.44, 2.88, 3.51, 3.69, 5.25, 5.3 and 3.88 respectively. The result displayed that corn flour concentration application increased from 0.0 to 100.0%, the sensory analyzes characterizealso decreased (Table 5).

Analysis of variance displayed that there were no significant two-way interactions between additive type × amount of corn flour ($P \geq 0.01$) (Table 5).

Table 5. Effect of different additive types and amount of corn flour on sensory (appearance, pore, texture, volume, shell color, ınner color, chewing, aroma, taste, general acceptability) in the corn bread.

Addition	Amount of corn flour	Appearance	Pore	Texture	Volume	Shell Color	Inner Color	Chewing	Aroma	Taste	General Acceptability
Additive	0.00	8.88	9.00	9.00	9.00	8.63	8.75	9.00	8.38	8.38	8.88
	10.0	8.25	8.75	8.25	8.63	8.38	8.25	8.38	8.25	8.25	8.50
	20.0	8.13	8.00	8.13	7.38	7.50	8.13	7.88	8.38	8.25	8.00
	30.0	7.50	7.50	7.50	7.38	7.38	7.25	7.75	7.63	7.50	7.50
	40.0	7.38	7.13	7.75	6.75	7.13	7.63	7.63	7.63	7.25	7.13
	50.0	6.50	7.00	6.25	6.38	6.75	6.63	7.00	7.75	7.50	6.75
	75.0	5.88	4.50	5.50	4.00	5.63	5.38	5.75	6.75	6.75	5.38
	100.0	4.00	4.00	5.38	3.75	4.25	4.38	4.75	6.25	6.25	4.75
	Average	**7.07 a**[1]	**6.99 a**	**7.22 a**	**6.66 a**	**6.96 a**	**7.05 a**	**7.27 a**	**7.63 a**	**7.52 a**	**7.11 a**
Without additive	0.00	6.93	7.50	7.00	6.50	6.00	6.88	7.13	6.13	6.00	6.13
	10.0	6.63	6.75	6.50	6.38	6.00	6.63	6.75	6.38	6.25	6.50
	20.0	6.88	6.63	6.00	6.13	5.75	6.38	6.13	6.50	6.00	5.63
	30.0	6.00	6.13	5.75	5.75	5.50	6.00	5.63	6.13	6.00	5.88
	40.0	5.13	5.38	5.88	4.25	5.13	6.00	5.50	6.25	5.63	5.25
	50.0	4.50a	3.75	4.25	3.38	4.88	4.88	4.00	5.75	6.00	4.75
	75.0	1.38	1.50	3.25	1.13	1.38	3.38	2.88	5.25	5.00	3.25
	100.0	1.50	1.38	2.50	1.13	1.50	2.63	2.63	4.25	4.50	3.00
	Average	**4.87 b**	**4.88 b**	**5.14 b**	**4.33 b**	**4.52 b**	**5.35 b**	**5.08 b**	**5.83 b**	**5.67 b**	**5.05 b**
Average (amount of corn flour)	0.00	7.91 a	8.25 a	8.00 a	7.75 a	7.32 a	7.82 a	8.07 a	7.26 a	7.19 a	7.51 a
	10.0	7.44 ab	7.75 ab	7.38 ab	7.51 ab	7.19 b	7.44 ab	7.57 ab	7.31 a	7.25 a	7.50 a
	20.0	7.50 ab	7.32 ab	7.07 ab	6.76 ab	6.63 a	7.26 a	7.01 ab	7.44 a	7.13 a	6.82 ab
	30.0	6.75 abc	6.82 abc	6.63 b	6.57 bc	6.44 a	6.63 ab	6.69 abc	6.88 ab	6.75 ab	6.69 a
	40.0	6.26 bc	6.25 bc	6.82 ab	5.50 cd	6.13 a	6.82 ab	6.57 bc	6.94 ab	6.44 ab	6.19 ab
	50.0	5.50 c	5.38 c	5.25 c	4.88 d	5.82 a	5.76 bc	5.50 cd	6.75 ab	6.75 ab	5.75 b
	75.0	3.63 d	3.00 d	4.38 dc	2.57 e	3.51 a	4.38 cd	4.32 de	6.00 bc	5.88 ab	4.32 c
	100.0	2.75 d	2.69 d	3.94 d	2.44 e	2.88 a	3.51 d	3.69 e	5.25 c	5.38 b	3.88 c
F value (additive type) A		55.00**[2]	33.00**	53.00**	83.00**	99.00**	20.00**	51.00**	72.00**	33.00**	43.00**
F value (Amount of corn flour) A		20.00**	16.00**	13.00**	33.00**	22.00**	8.50**	12.8**	6.3**	2.20**	9.50**
F value (A × A)		1.48 ns	0.52 ns	0.21 ns	070 ns	1.40 ns	0.04 ns	0.33 ns	0.26 ns	0.13 ns	016 ns

[1] The averages shown by the same letter are statistically different from each other ($P \leq 0.05$).

[2]**: Significant at $P \leq 0.01$, *: Significant at $P \leq 0.05$, ns: Non-significant at $P \geq 0.05$.

3.5.TPA properties of corn flour powdered bread of hardness, cohesively, elasticity, chew ability and gumminess values in the cornbread bread to different levels of corn flour and addition type

With regard to 0^{th}, first and second TPA characterize, analysis of variance (Table 6) displayed that there were significant differences between mostly parameters such as; hardness, cohesively, elasticity, chew ability and gumminess between additive type, different levels of corn flour and their interaction on the bread.

The results of mean comparison of 0^{st} TPA for additive type in the highest mean of hardness and gumminess parameters showed that were observed in without additive with 15.99 and 5.14 respectively, whereas the lowest was in additive with 5.27, 1.84 and 29.79 respectively, in addition to the highest mean of cohesively, elasticity parameters were observed in additive type with 0.42 and 0.79 whereas the lowest it was at without additive with 0.47 and 0.73 respectively. Also, the results of the mean comparison of first TPA for additive type in the highest mean of cohesively and gumminess parameters showed that were detected in without additive with 0.38 and 4.57 respectively, whereas the lowest was in additive with 0.28 and 1.46 respectively. While, the results of the mean comparison of second TPA for additive type in the highest mean of elasticity and chew ability parameters were observed in additive with 0.61 and 0.60 respectively, whereas the lowest was in without additive with 0.43 and -0.29 respectively, in addition to the highest mean of hardness, cohesively and gumminess parameters were observed in without additive type with 25.46, 0.30 and 5.87 whereas the lowest it was at additive with 8.51, 0.20 and 1.03 respectively.

Based on amount of corn flour application, the results of mean comparison of 0^{st} TPA for additive type in the highest mean of hardness in 75.0% with 26.32, in cohesively 0.0% with 0.60, in elasticity at 0.00 with 0.94, in chew ability at 50% with 3.52 and in gumminess 100.0% with 8.09 were observed respectively, whereas the lowest was in 0.0% with 1.39, 75% with 0.21, 75% with 0.58, 0.0% with 0.78, 0.0% with 0.82 respectively all the maintained parameters.Also, the results of mean comparison of first TPA for corn flour application, the highest mean of hardness in 100.0% with 45.92, in cohesively 10.0% with 0.50, in elasticity at 0.00 with 0.91, in chew ability at 50% with 2.78 and in gumminess 75.0% with 6.91 were observed respectively, whereas the lowest was in 100.0% with 0.08, 100.0% with -0.51, 100% with -1.44, 0.0% with 0.88, 0.0% with 2.85 respectively all the maintained parameters.While based on amount of corn flour application, the results of mean comparison of 2^{st} TPA for additive type in the highest mean of hardness in 100.0% with 9.94, in cohesively 10.0% with 0.44, in elasticity at 0.00 and 10.0% with 0.90, in chew ability at 50% with 3.25 and in gumminess 75.0% with 12.78 were observed respectively, whereas the lowest was in 0.0% with 2.85, 100% with 0.04, 100% with -0.56, 100.0% with -1.65, 0.0% with 1.08 respectively all the maintained parameters.

Analysis of variance displayed that there were significantly two-way interactions between additive type × amount of corn flour ($P \leq 0.01$) (Table 2). The results of mean comparison of 0^{st} TPA the highest mean of hardness in without additive + 100.0% with 42.18, in cohesively without additive + 0.0% with 0.66, in elasticity at without additive + 0.00 with 0.96, in chew ability at without additive 50.0% with 4.99 and in gumminess without additive + 100.0% with 11.76 were observed respectively, whereas the lowest were in without additive + 0.0% with 1.22, additive + 75% with 0.20, without additive + 100.0% with 0.35, additive + 30.0% with 0.72, without additive + 0.0% with 0.80 respectively all the maintained parameters.The results of mean comparison of 1^{st} TPA, the highest

mean of hardness in without additive + 100.0% with 69.28, in cohesively without additive + 0.0% with 0.60, in elasticity at without additive + 0.00 with 0.95, in chew ability at without additive 50.0% with 4.14 and in gumminess without additive + 75.0% with 12.47 were observed respectively, whereas the lowest were in without additive + 0.0% with 1.72, additive + 100% with 0.4 without additive + 100.0% with -0.42, without additive + 100.0% with -1.11, additive + 0.0% with 0.73 respectively all the maintained parameters.Also, the results of mean comparison of 1st TPA, the highest mean of hardness in without additive + 100.0% with 74.66, in cohesively without additive + 0.30% with 0.43, in elasticity at without additive + 0.00 with 0.93, in chew ability at without additive 50.0% with 4.57 and in gumminess without additive + 75.0% with 24.96 were observed respectively, whereas the lowest were in additive + 10.0% with 2.57, additive + 40.0% with 0.00, additive + 100.0% with -0.34, without additive + 75.0% with -13.28, additive + 40.0% with 0.001 respectively all the maintained parameters.

Table 6. Effect of different additive, additive free types and amount of corn flour on TPA properties (hardness, cohesively, elasticity, chew ability, and gumminess) in the corn bread.

Addition	Amount of corn flour	0th day					1st day					2nd day				
		Hardness	Cohesively	Elasticity	Chew ability	Gumminess	Hardness	Cohesively	Elasticity	Chew ability	Gumminess	Hardness	Cohesively	Elasticity	Chew ability	Gumminess
Additive	0.00	1.57 e[1]	0.54 a	0.93 a	0.78 de	0.84 d	2.25 e	0.33	0.87	0.64	0.73 c	2.95 d	0.37	0.87	0.96	1.10 ab
	10.0	1.68 e	0.52 ab	0.92 a	0.79 de	0.87 d	2.19 e	0.44	0.88	0.84	0.96 bc	2.57 d	0.49	0.88	1.10	1.26 ab
	20.0	2.24 de	0.36 bc	0.88 a	0.72 e	0.81 d	3.21 e	0.41	0.82	1.08	1.31 bc	3.88 d	0.18	0.83	0.62	0.77 ab
	30.0	2.13 de	0.51 ab	0.89 a	0.96 cde	1.08 d	3.24 de	0.30	0.82	0.81	1.00 bc	3.74 d	0.28	0.80	0.85	1.06 ab
	40.0	3.77 d	0.48 ab	0.82 b	1.49 bc	1.80 c	4.44 d	0.30	0.78	1.03	1.32 bc	7.34 c	0.00	0.85	0.00	0.001 b
	50.0	6.06 c	0.44 abc	0.77 b	2.05 ab	2.66 b	9.28 c	0.22	0.70	1.42	2.06 ab	12.41 b	0.19	0.79	1.92	2.47 a
	75.0	10.92 b	0.20 d	0.61 c	1.35 cd	2.21 bc	12.08 b	0.11	0.32	0.64	1.35 bc	9.94 bc	0.07	0.21	0.09	0.61 ab
	100.0	13.78 a	0.32 cd	0.47 d	2.10 a	4.42 a	22.56 a	0.13	-0.61	-1.76	2.96 a	25.22 a	0.04	-0.34	-0.74	1.00 ab
	Average	**5.27 b**	**0.42 a**	**0.79 a**	**1.28**	**1.84 b**	**7.40 b**	**0.28 b**	**0.57 a**	**0.59 a**	**1.46 b**	**8.51 b**	**0.20 b**	**0.61 a**	**0.60 a**	**1.03 b**
Without additive	0.00	1.22 d	0.66 a	0.96 a	0.77 b	0.80 d	1.72 f	0.60 a	0.95	0.97	1.02 c	2.74 f	0.40	0.93	0.98	1.05 c
	10.0	2.47 d	0.60 ab	0.92 ab	1.35 b	1.46 d	2.48 ef	0.55 a	0.91	1.24	1.37 c	2.96 f	0.39	0.91	1.03	1.13 c
	20.0	3.71 d	0.57 ab	0.89 bc	1.92 b	2.12 d	5.03 ef	0.49 a	0.82	2.04	2.49 bc	7.82 e	0.32	0.83	2.01	2.47 c
	30.0	4.93 d	0.56 bc	0.84 c	2.31 b	2.76 d	8.49 e	0.44 a	0.73	2.73	3.74 bc	8.98 e	0.43	0.74	2.84	3.83 c
	40.0	11.44 c	0.47 cd	0.72 d	3.88 a	5.37 c	14.51 d	0.38 a	0.67	3.71	5.53 bc	17.72 d	0.15	0.78	2.08	2.67 c
	50.0	20.29 b	0.40 d	0.62 e	4.99 a	8.06 b	25.23 c	0.29 a	0.56	4.14	7.43 b	29.90 c	0.26	0.59	4.57	7.78 b
	75.0	41.71 a	0.21 e	0.54 f	4.77 a	8.76 b	44.71 b	0.28 a	-0.14	-2.90	12.47 a	58.87 b	0.42	-0.54	-13.28	24.96 a
	100.0	42.18 a	0.29 e	0.35 g	4.21 a	11.76 a	69.28 a	0.04 a	-0.42	-1.11	2.52 bc	74.66 a	0.04	-0.79	-2.55	3.10 c
	Average	**15.99 a**	**0.47 b**	**0.73 b**	**3.03**	**5.14 a**	**21.43 a**	**0.38 a**	**0.51 a**	**1.35 a**	**4.57 a**	**25.46 a**	**0.30 a**	**0.43 b**	**-0.29 b**	**5.87 a**
Average (amount of corn flour)	0.00	1.39 d	0.60 a	0.94 a	0.78 d	0.82 d	1.98 f	0.46 a	0.91 a	0.80 abc	0.88 d	2.85 f	0.39 ab	0.90 a	0.97 a	1.08 c
	10.0	2.07 d	0.56 ab	0.92 ab	1.07 cd	1.17 d	2.34 f	0.50 a	0.90 a	1.04 ab	1.16 cd	2.76 f	0.44 a	0.90 a	1.07 b	1.19 c
	20.0	2.98 d	0.47 cd	0.89 bc	1.32 cd	1.47 d	4.12 ef	0.45 a	0.83 ab	1.56 a	1.90 cd	5.85 e	0.25 bc	0.83 a	1.31 b	1.62 c
	30.0	3.53 d	0.53 abc	0.86 c	1.63 c	1.92 d	5.86 e	0.37 ab	0.77 ab	1.77 a	2.37 abc	6.36 e	0.36 ab	0.77 a	1.85 b	2.45 c
	40.0	7.60 c	0.47 bcd	0.77 d	2.69 b	3.58 c	9.47 d	0.34 abc	0.82 ab	2.37 a	3.42 bc	12.53 d	0.08 cd	0.82 a	1.04 b	1.34 c
	50.0	13.17 b	0.42 d	0.70 e	3.52 a	5.36 b	17.25 c	0.26 bcd	0.69 b	2.78 a	4.75 ab	21.16 c	0.23 bc	0.69 a	3.25 a	5.12 b
	75.0	26.32 a	0.21 f	0.58 f	3.06 ab	5.49 b	28.40 b	0.19 cd	0.18 d	-1.13 bc	6.91 a	34.40 b	0.24 bc	-0.17 b	-6.59 d	12.78 a
	100.0	27.98 a	0.30 e	0.41 g	3.16 ab	8.09 a	45.92 a	0.08 d	-0.51 c	-1.44 c	2.74 abc	49.94 a	0.04 d	-0.56 c	-1.65 c	2.05 c
F value (additive type) A		363.00**[2]	6.70*	36.00**	102.00**	154.00**	425.00**	12.90**	2.30 ns	2.1 ns	34.00**	1031.00**	6.00*	540.00*	9.68**	171.00**
F value (Amount of corn flour) A		187.00**	24.70**	219.00**	19.30**	48.00**	262.00**	6.40**	66.2**	4.1**	7.00**	529.00**	6.06**	260.00**	56.20**	58.00**
F value (A × A)		62.00**	2.70*	7.00**	5.80**	14.00**	79.00**	0.47 ns	2.50 ns	1.73 ns	6.00**	192.00**	1.37 ns	1.65 ns	41.80ns	59.00**

[1]The averages shown by the same letter are statistically different from each other ($P \leq 0.05$).

[2]**: Significant at $P \leq 0.01$, *: Significant at $P \leq 0.05$, ns: Non-significant at $P \geq 0.05$.

4. Discussion

4.1.Bread mass, volume and specific volume values of bread added to different levels of corn flour

According to interaction effects of additive type and amount of corn flour, the highest mass, volume and specific volume values in additive + %40 amount of corn flour (137.48 g), additive + %0.0 amount of corn (612.50 ml) and additive + %0.0 amount of corn (4.55 ml) respectively was achieved (Table 2).The properties of the inner part of the bread being formed at the desired quality, the effects of improving the properties of the inner part of the oil, and during their doughing and processing; Depends on the fractions that can be found solid at the paste temperature [10]. The shortening, especially the dough, must be sufficiently solid during the final fermentation that the inclusion of solid crystalline fractions is necessary to have a positive effect on bread characteristics [11]. The use of yogurt in bread making positively affects the rheological properties of the dough, the volume of bread, specific volume, crust color, bread texture and coloring [12]. Our result presented that the volume and specific volume values decreased as the corn flour contribution level increased. In bulk, an increase was observed up to the addition of 50% corn flour and then a decrease was observed. This decrease mass leads to a relative decrease in the gluten content of the flour formulation and consequently a reduction in the gas holding capacity. [19], added that the solid fat added to the plow increased the gas holding capacity, and increased the bread volume, in the early stages of cooking [20]. Since the lecithin in the yogurt is characterized by the emulsifier, it improves the structure of the pastry positively. [21], In their study, investigated the effect of lecithin and monoglycerides on the rheological quality and flatbread quality of the dough. It has been observed that these materials alone or in combination improve the rheological properties of the dough and the firing quality. The increase in viscoelastic properties of the wheat flour paste is attributed to the gluten content of the flour [7]. At the same time, the fermentation of the sugars keeps the gas cells in the resulting pasteurization of the dough. During cooking, gluten counteractively increases the stability of the dough and the internal structure and volume of the product [22]. With the addition of corn flour, the gluten net weakens, results in a decrease of gas retention, dough elasticity, pulp expansion and of the bread [23].

4.2.Crust color and inner color in the cornbread to different levels of corn flour and addition type

Variance analysis of this study was shown in 1st and 2nd repeat of L, a and b color values of crusts of corn flour added the bread at different levels were statistically highly significant ($p \leq 0,01$).Duncan Multiple comparison test results of the mean values of L, a and b color values of the corn flour variant was demonstrated that the additive made to flour causes the intensity of red color in the shell color to increase, while the value of L in the shell decreases, while the color value of b does not cause any change. The increase in the color value of the crust + a (red) can be explained by the caramelization and Maillard reaction during the addition of the lactose in the added yogurt. [12], According to the studies they performed, the rheological properties of yoghurt underwater at a rate of 1.0% over the dry matter were statistically increased ($p \leq 0.05$) compared to other additive ratios and unadulterated walnut bread, palatability, specific, shell color, bread texture, and color. The addition of added corn flour causes both the crust L value of the crust and the + b color value (yellow) to increase and the + a color (red) value to decrease. Gluten-free bread doughs are in a fluid structure, and after firing, crumbly textured and poor color are formed [24, 25].

Also, the added flour increased the value of a while it did not cause any change in the L and b color values of the bread. [26], The effect of fat substitutes such as inulin husk, inulin gel, and simplest on rheological properties of the dough and quality of the wheat bran were investigated. Volume yield, in-bread texture, crust color and in-bread image characteristics measured for cooked nuts. In fat-containing doughs, the dough complex module is lower than the fat-substitute doughs. The addition of corn flour added increased the color value of L and b for bread, caused the green color to turn yellow first and then to increase this value. Other end-product qualities such as texture, volume, color, appearance, and taste are negatively affected in wheat flour gluten-free products and quality problems arise [27].

4.3.Moisture values in the cornbread to different levels of corn flour and addition type

The first and second recurrence results of moisture values of corn flour-added to bread at different levels were statistically highly significant ($p \leq 0.01$). The addition of the additives to the flour caused a decrease in moisture values after 0, 1st and 2nd days of the bread. While the storage time increases, the stalks stiffness increase. [28], observed that as the storage period increases, the bread hardness increased and the elasticity and cohesiveness values of the bread decreased. [29], found an increase in crumb moisture, crumbling, stiffness and opacity, and a decrease in bread moisture [30]. Corn flour content causes a decrease in the moisture content in both unpacked and first and second day bread. As the corn flour level increased, the moisture level in the bread decreased. While the added corn flour was 0%, the bread moisture content was the highest, and the lowest bread moisture level was for 100% corn flour addition.

4.4.Sensory analyzes in the cornbread to different levels of corn flour and addition type

The results of the first and second replicates of values of the appearance, pore, texture and volume from the sensory analysis of corn flour flour added bread at different levels were statistically highly significant at ($p \leq 0.01$) on appearance, pore, texture and volume values of the bread. The additives additions to the flour give an increase in the bread appearance, pore, texture and volume. [16], investigate the effect of yeast and herbal shorts on the textural and physical properties of partially cooked frozen bread. The results obtained after four weeks of storage showed that hardness and chewing values increased as there was no significant change in tack and resilience, as is true for all formulations. Shortening added bread showed lower hardness and chewing values due to the softening effects of it. Also, the addition of corn flour affects the appearance of the bread, pore, texture and volume negatively. The use of yogurt in making bread, positively affects the rheological properties of the dough, volume, specific volume, crust color, texture and color of the bread [12]. [13], While the dough softness decreased with the addition of eggs, the farinograph increased the dough development time and stability. The lecithin emulsifier characteristic of the yolk it improves the structure of the pastry positively.

The sensory analysis results of corn flour added breads of the first and second interaction of crust color, inner color, and chewing values at different was verified that the additives variables and corn flour addition were found to be statistically highly significant at ($p \leq 0.01$) in shell color, inner color and chewing values of the bread. The main variance of additive variable sources showed the added corn flour reduces the appreciation of chew ability, bread crust and crumb color. The addition of corn flour increases bread crust hardness and of the bread to be harder and the pore structure of the bread crumb which the reason for bread volume deterioration, resulting in an increase of the yellow pigment due to beta-corn starch in corn.

Results of the first and second interaction of sensory analysis of flavor, taste and general acceptability values of corn flour-added bread at different levels were statistically highly significant at ($p \leq 0.01$). The added flour made to the bread increased the flavor, taste and overall acceptability values. While Table 3.28, shows that the added corn flour made negative affects the flavor, taste and overall acceptability of the bread. Because white and baked bread have neutral taste and aroma, the people who are constantly consuming such bread are also used to those bread. However, panelists did not like the unique taste and flavor of cornbread because they did not consume cornbread before, and they evaluated the overall acceptability of it with low scores.

4.5.TPA properties of corn flour powdered bread of hardness, cohesively, elasticity, chew ability and gumminess values in the cornbread to different levels of corn flour and the addition type

The first and second recurrence results of day 0th of the hardness, cohesiveness, elasticity, chew ability and gumminess values determined in TPA of corn flour-added breads at different levels the added flour made additive reduces the hardness values on days 0th, first and second for breadcrumb. The decrease in bread hardness may also be due to lactic acid bacteria which found in yogurt. [28], He observed that the bread softness values of in which the lactic acid bacteria were used were higher in the significant level than the unmixed bread. [31], Water storage capacity and softness values increased as storage period increased, and softness values of bread were observed to decrease.

As shown in Table 5, added corn flour increased the hardness value on days first and second. The hardest cornbread's were observed in the inner part of the bread with 100% corn flour added. As seen in Table 5, the added flour additive reduces the cohesive values on days first and secondof the bread. Also result verified, added corn flour decreased the cohesive value on days first and secondof the bread. The minimum cohesive corn bread was observed in corn bread with 100% corn flour added, while the highest values were observed in 0% corn flour added breads. Also, the added flour additive increases the elasticity values on days first and secondfor bread inner part. In this study with added corn flour decrease the elasticity value on days first and secondof the bread. The lowest elasticity cornbread's were observed in cornbread's with 100% corn flour added, while the highest values were observed in 0% corn flour added breads. Our result showed that the added flour additive decrease the Chewiness values on days 0th and second for bread inner part. Also, addition of corn flour causes an increase in chew ability value on day 0 and a decrease chew ability of bread on days 1 and 2 with a decrease in moisture content. The highest values of chewiness were obtained on day 0 bread with 100% corn flour, while the lowest values were observed in 0% corn flour added bread. The lowest values in the chewiness values of the first and second day bread are in cornbread's with 100% corn flour added. The added flour has reduced the gumminess values of the bread inner on days 0th, 1 and 2. Gluten is the main protein responsible for the appearance and bread inner structure, responsible for the elasticity and extensibility properties of the dough. For this reason, it is primarily responsible for the bread quality [27]. As seen in Table 5, the addition of corn flour caused an increase in the value of gumminess on days 0th, first and second. The highest gumminess values were obtained in cornbread's supplemented with 75% and 100% corn flour, while the lowest values were observed in 0% corn flour added bread.

5.Conclusion

In this study, the additives added to corn flour; mass, volume, specific volume, the red colour intensity in the crust, the moisture content of the 0, 1st and 2nd days of bread was decreased, so the

appearance of the additive added to the flour has reduced the pore, texture, and volume. The contribution made from flour bread crust has reduced colour, internal colour, and chewing values. The addition of flour resulted in a decrease in cohesive values on 0, 1st and 2nd days for bread. The addition of flour resulted in decreased elasticity values at 0, 1st and 2nd days for bread. The contribution made to flour decreased on the 1st and 2nd days of bread for chewiness values it has caused. The addition of flour resulted in a decrease in the gaminess values on the 0, 1st and 2nd days for bread. In contrast to, L colour value, b colour value in the crust, red (a) colour on the inner was increased. The addition of flour resulted in an increase in hardness values on 0, 1st and 2nd days for bread. In this research, with an increase of corn flour in bread, the values of mass, volume, and specific volume decreased. The appearance of corn flour for bread affects the pore, texture and volume values negatively. The corn has reduced the chewing ability of the flour, the bread crust and the likeness of the inner colour. Corn flour has affected the flavour, taste and overall acceptability of the bread in the negative direction. Corn flour caused the decline of cohesive value on the 1st and 2nd days and the 0th day of sowing. Corn flour caused a decrease in the elasticity value on 0, 1st and 2nd days of the bread. The addition of corn flour resulted in a decrease in the viability of the cultivars on 1st and 2nd days when the value of chew ability increased on day 0, while the added corn flour caused an increase in the blue pigment for the bread. Flour added additives have increased the value of bread flavour, taste, and overall acceptability. Corn flour caused an increase in the value of hardness of 0, 1st and 2nd days of the bread. The addition of corn flour resulted in an increase in the gum value on the 1st, 2nd days and the 0. Day.

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DETERMINATION OF SILAGE QUALITY CHARACTERISTICS OF FEED PEAS *(Pisum sativum L.)*, TRITICALE AND MIXTURES GROWN IN DIYARBAKIR CONDITIONS

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Abstract:

This research was aimed to determine the quality characteristics of the silages obtained from the feed peas (Pisum sativumsupsp arvense L.), triticale and their mixtures cultivated in Diyarbakır provinces. In this study, experimental groups were composed of 5 groups consisting of 3 repeats, triticale and mixtures of different levels which are; 1) Feed peas, 2) Triticale, 3) Feed peas (50 %) + Triticale (50 %), 4) Feed peas (25%) + Triticale (75 %) and 5) Feed peas (75 %) + Triticale (25 %). The samples were analyzed after 60 days of incubation in 2 kg plastic drums. In chemical analyzes; the highest pH value (4.15) was obtained from the triticale silage, while the lowest pH value (4.08) was obtained from the feed beetle silage (P <0.05). Similarly, lactic acid concentration was the highest (2.19%) in the silage, while the lowest level (1.96%) was found in the feed beetle silage (P <0.05). As a result; Increase of feed peas ratio in ensiled material increased the ratio of CP, ADF, NDF, propionic acid and acetic acid, which is a desirable feature in a quality silage, but decreased lactic acid ratio. In addition, it was determined that mixture of triticale and feed pea plants with 25 % of feed peas + 75% triticale is the most ideal mixture in terms of silage quality in the areas having the ecological conditions of Diyarbakır province.

Key words*: Feed peas silage, triticale silage, different mixing ratios, Diyarbakır conditions.*

1. Introduction

Livestock in our country has a great importance in the general economy and agriculture. Our country is very suitable for animal husbandry in terms of natural resources and ecological conditions. Turkish Statistical Institute (TÜİK) reports that our livestock assets approaching 15 million heads have reached 44 million head in the first quarter of 2017 [1].

The amount and quality of the feed sources used in the ruminant nutrition which constitute the main source of meat and milk production and the ration formulation are extremely important for an economical and successful production. In animal production, feed and animal feeding costs account for approximately 70% of the total cost of the enterprises. This rate may vary according to various factors. These factors are generally the mode of production, the type of animal being raised, the size of the farm, and the condition of supply, the mode of feeding and the mechanization of the equipment. The animal

species and the feeding characteristics of the animals may affect the share of feed supply in production costs due to the need for feed.

It is important to meet the roughage requirement of ruminant animals with the combined roughage feed mixture in the feeding of ruminant animals [2]. The majority of ruminant animals in our country are undernourished by roughage. Therefore, the regulations on feeding are very important for the production and development of cheap and qualified ratios [3].

The main source of roughage of cattle and sheep animals are pasture and pasture plants, crop production residues and fodder crops such as alfalfa, vetch, sainfoin and forage peas, and silage made from them. Silage is generally made from the fodder crops mixtures or maize plant. Triticale is a hybrid of wheat and rye that belongs to the wheat family, is a grain used in animal feed, quality roughage supply and silage production [4]. Feed peas are one of the important plant materials belonging to the leguminous family and it is similar to alfalfa silage in terms of nutrient content. Harvest times of plants are important for growing silage material in mixed form. Leguminous fodder crops are rich in protein but exhibit difficulty in ensilaging alone. Grain forage crops are good in terms of protein, although they are good in digestible carbohydrate content. For this reason, mixing of the plants belonging to these two families by mixing them in appropriate proportions will enable to obtain high quality roughage [5].

The aim of this study is to determine the quality of the silage made by the different rate of feed peas and triticale in cultivated in the ecological of conditions of Diyarbakır.

2. Materials and Methods

In this study, feed plants used in silages with quality characteristics were grown in the trial areas of Diyarbakır GAP International Agricultural Research and Training Center. The feed pea (GAP pink) registered by GAP International Agricultural Research and Training Center, Triticale (Karma - 2000) were used as a plant material.

Feed peas were harvested at the beginning of flowering and triticale were harvested during the flowering period and overturned in the shade. Plants that have been fading have been chopped about 2-3 cm in size. The harvesting process was done with a sickle and a knife. The plant materials which are ready for mixing are weighed in 2 kg plastic drums by weighing and mixing them in different ratios. All mixtures in the indicated proportions were stored in a dark and cool environment for 60 days. In this study, experimental groups were composed of 5 groups consisting of 3 repeats, triticale and mixtures of different levels which are1) Feed peas, 2) Triticale, 3) Feed peas (50 %) + Triticale (50 %), 4) Feed peas (25%) + Triticale (75 %) and 5) Feed peas (75 %) + Triticale (25 %). Samples were taken from the drums under suitable conditions after 60 days fermentation period and then physical and chemical analyzes were made. The data were analyzed by using the one-way ANOVA with the General Linear Model (GLM) procedure of SPSS 16.0 (2011). Statistical significance was considered at $P < 0.05$. Differences among means were evaluated using Tukey's test.

Results and Discussion

Results obtained from this study showed that in particular, feed peas (25%) + triticale (75%) mixture silages were found to be superior in terms of quality and fleig score compared to feed pea (50%) + triticale (50%) and feed pea (75%) + triticale (25%) mixture silages ($P < 0.05$) (Table 1). As seen in Table 1, the fleig score was in the range of 115.8 to 95.7%, the highest fleig score was found in 115.8

to triticale (100%) silage and the lowest fleig score in 95.7 to 100% feed pea silage. Geren [6], Dracma, SG-304 and P-3163 corn cultivated as the second product in the study with the highest flieg score Dracma varieties of 100 points, and the lowest flieg score with 87 points reported that SG-304 varieties. Similarly, Öten et al. [7], maize, sorghum, alfalfa, sponges and their different ratio of silage in the ratio of 100 points and the scores of the fleig scores reported in their study.

Table 1. Results of Physical Analysis

Groups	Color	Fleig Point	Quality
1.Feed Peas (100%)	Olive green	95.71^{d}	Moderate
2.Triticale (100%)	Olive green	115.84^{a}	Satisfactory
3.Feed Peas (50%) + Triticale	Brown green	104.47^{c}	Satisfactory
4.Feed Peas (25%) + Triticale	Brown green	110.48^{b}	Good
5.Feed Peas (75%) + Triticale	Brown green	103.25^{c}	Satisfactory

The most important method to be used in the determination of silage quality is chemical analysis. In chemical analysis; the level of organic acids such as lactic acid, acetic acid, propionic acid and butyric acid were determined after the fermentation period. Dry matter, crude ash, crude protein, acid detergent fiber (ADF), Neutral Detergent Fiber (NDF) values are given in Table 2. As a result of the research, the highest dry matter rate was found in 38.48% of 100% triticale silage and the lowest dry matter ratio was found in 27.02% and 100% feed pea silage ($P < 0.05$). Our findings were agree with the results obtained by Fayetörbay et al. [8], feed pea *(Pisum arvense L.),* wheat *(Triticum aestvium L.)* and silages in different ratios. Similarly, Güre [9] reported that the average silage dry matter rate was 25.3% in the silages prepared with different proportions of sweet millet and cowpea.

Table 2. Results of Chemical Analysis

Groups	DM, %	Ash,%	CP, %	ADF,%	NDF,%
1.Feed Peas(100%)	27.0^{d}	8.00	15.4^{a}	35.3^{a}	45.3^{bc}
2.Triticale (100%)	38.5^{a}	8.08	9.7^{c}	26.3^{b}	44.7^{c}
3.Feed Peas (50%) + Triticale (50%)	32.7^{c}	8.03	11.3^{bc}	29.6^{ab}	46.4^{bc}
4.Feed Peas (25%) + Triticale (75%)	35.6^{b}	7.68	11.1^{c}	27.4^{b}	51.8^{ab}
5.Feed Peas (75%) + Triticale (25%)	31.8^{c}	7.72	13.4^{ab}	28.6^{b}	54.0^{a}
P Value	0.000	0.508	0.000	0.007	0.003
SEM	1.045	0.088	0.562	0.984	1.132
NS	**	NS	**	**	**

^{a,b,c,d} Means within a column without a common superscripts differ statistically ($P < 0.05$). *: $P<0.05$, **: $P<0.01$, SEM: Pooled standard error of mean, NS: No significant ($P>0.05$), DM: Dry matter, CP: Crude protein, ADF: Acid detergent fiber, NDF: Neutral Detergent Fiber.

The highest crude protein content was 15.4% from 100% forage pea silage and the lowest crude protein content was 9.72% for 100% triticale silage. The crude protein content was increased in the feed

peas ratio in the mixture, the crude protein content is increased. The highest ADF ratio was found in 35.32% of the feed pea silage and the lowest ADF ratio was 26.30% in triticale silage (P <0.05). The results of this study are similar to those of Ngongoni et al. [10].

The results of the pH and organic acid measured in the silages samples are given in Table 3. Statistically significant difference was found between the experimental groups in terms of pH values (P <0.05). Table 3 shows that the highest silage pH value was found to be 4.15% from 100% triticale silage, while the lowest silage pH value was obtained from 4.08% 100% feed pea silage. In a high quality silage, the lactic acid ratio should be above 2% [11]. As a result of the study, lactic acid ratio was found to be between 1.96% and 2.19%, the highest lactic acid ratio was found from 2.19% to 100% triticale silage and the lowest lactic acid ratio was found to be 1.96% and 100% feed pea silage. In addition, the rate of butyric acid is in the range of 0.004% to 0.009%, the highest butyric acid ratio is 0.009% to 75% of the feed peas + 25% triticale and 25% of the pea beetle + 75% triticale mixture and the lowest butyric acid ratio is 0.004%. It was determined from 100% forage pea silage. Table 3 shows that the ratio of acetic acid was in the range of 0.3% to 0.7%, the highest acetic acid content was found to be 0.7% to 100% of the feed pea silage, and the lowest acetic acid ratio was 0.3% to 100% triticale silage.

Table 3. Results of pH and Organic Acid Analysis

Groups	**pH**	**LA**	**BA**	**PA**	**AA**
1.Feed Peas(100%)	4.08^{b}	1.96^{d}	0.004^{b}	0.1^{d}	0.7^{a}
2.Triticale (100%)	4.15^{a}	2.19^{a}	0.005^{b}	0.4^{b}	0.3^{d}
3.Feed Peas (50%) + Triticale (50%)	4.14^{a}	2.09^{b}	0.008^{a}	0.3^{c}	0.5^{c}
4.Feed Peas (25%) + Triticale (75%)	4.14^{a}	2.15^{a}	0.009^{a}	0.6^{a}	0.4^{d}
5.Feed Peas (75%) + Triticale (25%)	4.13^{ab}	2.01^{c}	0.009^{a}	0.7^{a}	0.6^{b}
P Value	0.007	0.000	0.000	0.000	0.000
SEM	0.008	0.023	0.000	0.05	0.37
ND	**	**	**	**	**

^{a,b,c,d} Means within a column without a common superscripts differ statistically (P < 0.05). *: P<0.05, **: P<0.01, SEM: Pooled standard error of mean, NS: No significant (P>0.05), LA: Lactic acid, PA: propionic acid, BA: Butyric acid, AA: Acetic acid.

In conclusion, the increase of feed peas in the silage mixture resulted in an increase in the ratio of CP, ADF, NDF, propionic acid and acetic acid, which was desired in a good quality silage, and decreased in lactic acid ratio. In addition, the fleig score was very good in all applications. Our results showed that 25% of the feed pea and 75% of the triticale mixture is an ideal mixture in terms of silage quality.

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PERFORMANCE ANALYSIS OF CLASSIFICATION ALGORITHMS OF SEVERAL DATA MINING SOFTWARES

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Abstract: *Data mining is to find correlations and rules which ensure meaningful and potentially useful estimations to be carried out for future among vast amount of existing data through computer programs. Today, many commercial or open source software tools are used regarding this matter. In this study, Classfication Analysis comparisons were carried out over the car evaluation data set consisting of 1728 registers especially on Weka, Orange, KNIME and Tanagra as open source software tools.*

Keywords: Data Mining,Classfication Analysis, Open Source Data Mining Tools

1. Introduction

It is estimated that the total size of the data produced by humanity in 2020 will reach 44 zettabytes (44 trillion GB)[3]. As predicted that the amount of information doubles every 20 months, opportunities of data gathering and storing this gathered data are increasing. Today, even the most basic actions such as using credit cards, medical test results, telephone conversations, purchasing products on supermarket at a time are being registered on computer environment. Businesses and goverment agencies are having more investment on data base system and storing more data on this system day by day. To take advantage of this large format data, it is needed to discovering valuable information by applying methods and rules over these data[4].

Data mining is discovering connections and regulations which are meaningful in a great available data, potentially useful and ensuring predictions about future by using computer programs. One of the data mining application areas which are becoming widespread in many sectors is the market basket analysis in which connections and rules are obtained by benefiting from customer, product and sale informations at supermarkets. Obtaining sale connections of products on market basket analysis and establishing association rules which is one of data mining matters are the profit

growning factors of companies. Association rules supply producing prudential predictions by discovering objects which act together inside sale action data and correlations between objects. Since the beginning of 90s, many algorithms have been developed to obtain these rules. It is available that these algorithms have superiorities on each other in different conditions and they have different working methods. Data base searching, applying defragmentation and pruning methods and discovering association connections between objects with minimum support value help constitute formal logic of algorithms[5].

To study on Data Mining, it is necessary to use programs developed for this matter. Lots of commercial and open source programs[1] are developed in this context. The main commercial programs are SAP Kxen, SPSS Clementine, SAS, Angoss, SQL Server, MATLAB, the top five of open source software are Orange, RapidMiner[6], Weka ,JHepWork, KNIME , Tanagra [7].

2. Data Mining Processes

Data Mining Processing consists of many stages. The main Data Mining Processing stages are below. These are;

1) Understanding problem area
2) Data selection
3) Preprocessing and data cleaning
4) Model Setup
5) Interpretation and Validation of the model

2.1. Understanmding Problem Area

The stage of understanding problem area requires gathering knowledge about the problem besides defining the problem and the objective of the study. Use of data mining techniuques without a proper understanding of the problem domain and sufficient knowledge mostly results with discovering irrelevant or meaningless information.

2.2. Data Selection

The data selection step requires user to aim at a data base and to select attributes and data for model creation. Having understood the problem area helps to select beneficial data on this step. Sometimes sufficient data is not available on a company structure. In this circumstance, data is obtained from external source.

2.3. Data Cleaning and Preprocessing

This step is the most time consuming step of all data mining processing. Raw data is usually neither neat nor suitable for data mining. The followings are the situations to be taken into consideration during the preprocessing and data cleaning step in order to prepare the data for further processing:

2.3.1 Data Cleaning

- Repetition: This kind of data conflict occurs when a sample exists several times in the data. This is the most common data conflict issue seen on the databases of companies like the credit card firms that personally deals with customers.
- Deficient Data Fields: There can be deficient fields on a data base for a variety of reasons. For example the customer filling a registry form may be bored with filling out required information or there can be deficient value because of inappropriate data entry in the field.
- Outliers: Outlier value in a field is the value that varies from the other values in the same field. As an example of this, think about monthly energy consumptions of customers in a public organization. If the values in this field are typically in between 0-1000KW and if we have 10,000KW entry for some customers, then these extreme values are described as outliers.

2.3.2 Preprocessing

On this step data selection is made depending on model to be set up. For example; for an estimator model, this step has the meaning for variable selection which will be used on model for dependent and independent variables selection.

Meaningless variables such as sequence number, ID number shouldn't go into model. Because these kind of variables can cause reduction in contribution of other variables on model and extending time to reach data. Some data mining softwares automatically eliminate these kind of irrelevant variables, however, it will be more rational not to leave it to the software in practice.

For example; demonstration of actual birthdate of each customer in practice can have adverse effect. Instead, seperating and grouping customers into different ages can be better.

2.4. Model Setup

We can say that model setup is the centre for all data mining application. It is the stage in which secret patterns and tendencies in this data come to light. There are lots of approaches about model setup stage. These are assembly, classification, clustering, alignment analysis and monitoring. Each approach can be put into practice by using one of the competitive methods such as statistical data analysis, machine learning and neurotic operations. The reason why data mining is mostly thought as an interdisciplinary area is that a large variety of methods from different disciplines are being used.

2.5. Interpretation and Validation

Interpretation and validation step of data mining is used for evaluating qualifications and values of the resulting model to determine whether turning back on previous steps by user is necessary or not. It is very important to understand the problem to appraise the result of the resulting model in this step.

3. Data Set Example

As specified on Table-1 below, Vehicle evaluation data set[2] consists of 1728 recordings and areas such as purchasing car, maintenance cost, number of doors, passenger capacity, luggage width and vehicle safety. In the classification algorithms used in this study, 66% of the samples in the set were used for learning and 34% were used for testing of the models.

Vehicle Evaluation Data Set		Area:7	Recording:1728
Area	**Type**	**Content**	**Information**
Buying	Discrete	vhigh,high,med,low	Purchase Price
Maint	Discrete	vhigh,high,med,low	Maintenance Price
Doors	Discrete	2,3,4,5more	Number of doors
Persons	Discrete	2, 4, more	Carrying Capacity
Luggage	Discrete	Small, med, big	Luggage Capacity
Safety	Discrete	Low, med, high	Safety Level
Class	Discrete	unacc, acc, good, vgood	Vehicle acceptance status

Table 1. Vehicle Evaluation Data Design Table

4. Processes and Data Mining Softwares Used

4.1. Weka

Weka software which has been developed open source on java by Waikato University and is still developing owns data classification, clustering, association and monitoring features. The name of Weka, is a software consisting of first letters of "Waikato Environment for Knowledge Analysis". Weka has totally a modular design and can make operations like visualization on data clustering, data analysis, business mind applications, data mining. Weka software comes idiocratically with support of .arff extention. But in Weka software, there are also vehicles for conversion CSV files into ARFF format. [8] It is not possible to process data on any text file with Weka, Arff, Csv, C4.5 formatted files. Also by using Jdbc and connecting data base, operations can be taken here.

Basically 3 Data Mining operation can be taken with Weka:

- (Classification)
- (Clustering)
- (Association)

Also, in addition to operations above, pre-processing and after-processing can be taken on data clusters.

- (Data Pre-Processing)
- (Visualization)

Lastly, there are plenty of built-in function working on files including data clusters on Weka Library. For Weka application, the data set given in Table 1 was converted to arff format as given below and the classification algorithms on this arff data were tested as given in Figure 1. Test results are given in Table 2

ARFF formatted vehicle evaluation data set recording design:

@RELATION CarTable
@ATTRIBUTE Buying {vhigh,high,med,low}
@ATTRIBUTE Maint {vhigh,high,med,low}
@ATTRIBUTE Doors {2,3,4,5more}
@ATTRIBUTE Persons {2,4,more}
@ATTRIBUTE Luggage {small,med,big}
@ATTRIBUTE Safety {low,med,high}
@ATTRIBUTE Class {unacc,acc,good,vgood}

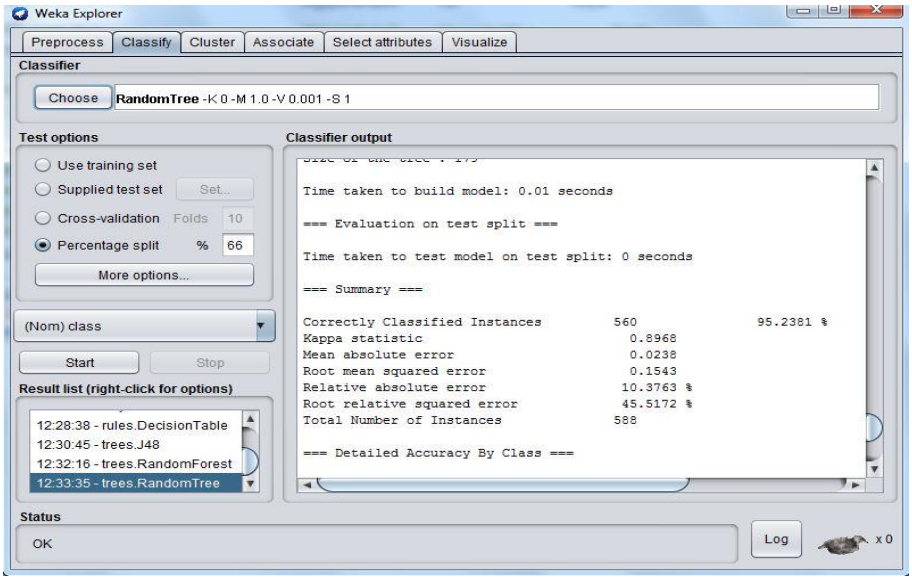

Figure 1. Result image in Weka software

Algorithm	Accuracy Rate
Tree J48	90.98
Decition Table	86.90
Lazy IBk	90.64
NaiveBayes	87.58
Random Forest	92.51
Lazy Kstar	86.39
Random Tree	84.01

Table 2. Weka application algorithm results

4.2 Orange

ORANGE software is developed by artificial intelligence research team on Slovenia Ljubljana University Computer and Information Science department.Orange is a data mining and machine learning application which is written by using C++ and Python and which uses Qt framework cross-platform for grafical interface. It consists of wide ranging component set such as user-friendly strong and flexible, data pre-processing, scoring feature and filtering, modelling, model evaluation and

discovery techniques. Orange can read data on *.tab, *.txt, *.basket, *.names, *.csv, *.tsv, *.arff, *.xml, *.svm file types . As shown in Figure 2 in Orange application, the results given in Table 3 were found.

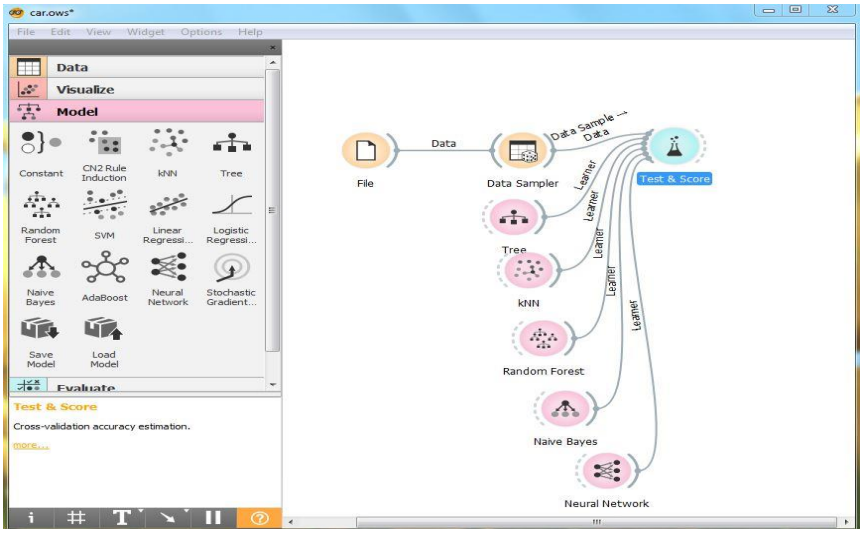

Figure 2. Result image in Orange software

Algorithm	Accuracy Rate
k Nearest Neighbor	87.70
Tree	95.00
Random Forest	91.71
Neural Network	97.12
Naive Bayes	85.75
AdaBoost	94.10
Costant	70.15

Table 3. Orange application algorithm results

4.3. Knime

It is developed by Konstanz University visual data mining research team on Eclipse Rich Client Platform.[9] Almost all data mining methods used frequently are available on this software. Among them, methods like support vector machines, Bayes and Multi dimensional Scaling (MDS) are also available. Knime can read data from files of *.txt., *.csv ,*.arff and also supports data read operation based on XML named PMML (Predictive Model Markup Language) which submits an opportunity to transfer data between data mining and statistical applications and access data with SQL querries from database servers. KNIME also has Data Write component which is useful for writing the data read on a different format which doesn't exist in the similar programs. As shown in Figure 3 in Knime application, the results given in Table 4 were found.

Algorithm	Accuracy Rate
Naive Bayes	87.76
Decision Tree	92.90
Gradient Boosted Tree	84.70
Random Forest	95.90
Tree Ensemble	95.60
Logistic Regression	92.50
k Nearest Neighbor	95.43

Table 4. Knime application algorithm results

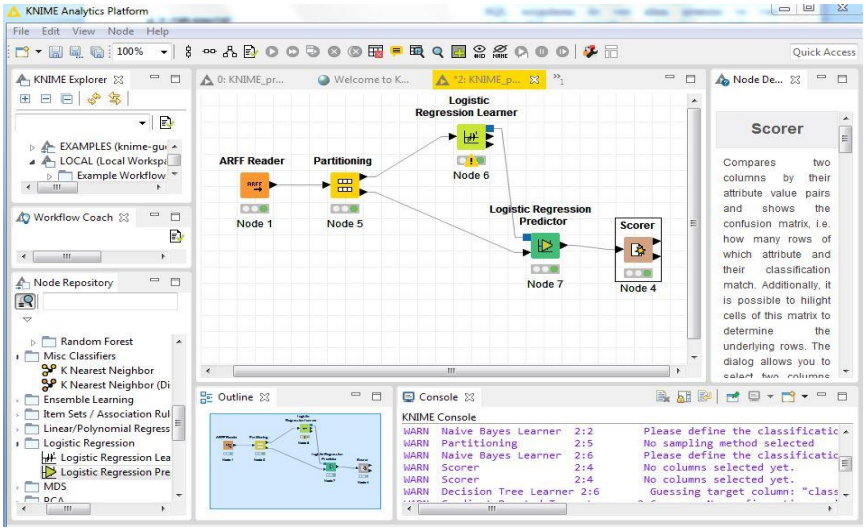

Figure 3. Result image in Knime software

4.4. Tanagra

Tanagra provides lots of data mining methods like Data analysis, statistical and machine learning. Tanagra consists of controlled learnings such as clustering, factorial analysis, parametric and nonparametric statistic, association rule, feature selection and structure algorithm and also other paradigms. [10]. Tanagra can read data from *.txt, *.ls, *.arff ve *.dat extention files. In the Tanagra application, the values given in Table 5 were found in the classification tests shown in Figure 4.

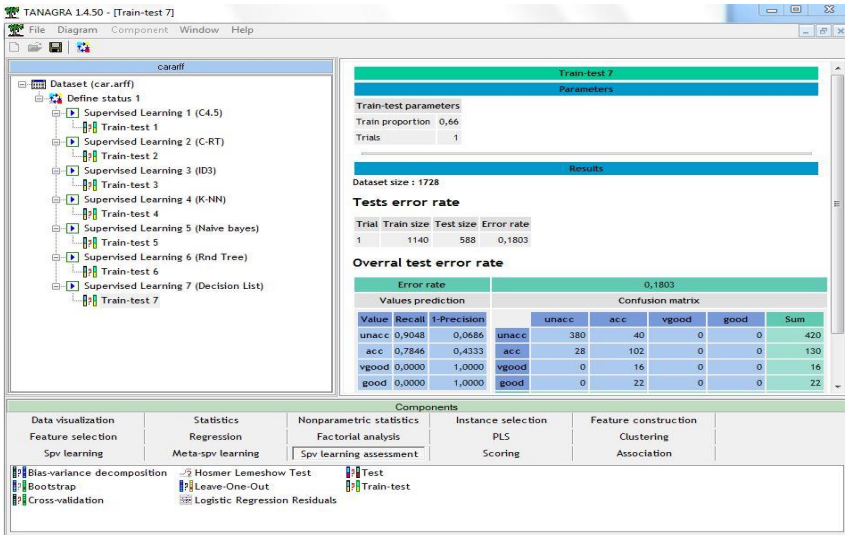

Figure 4. Result image in Tanagra software

Algorithm	Accuracy Rate
ID3	74.49
k Nearest Neighbor	81.80
C-RT	88.44
C4.5	86.90
Naive bayes	84.86
Random Tree	81.12
Decision List	81.97

Table 5. Tanagra application algorithm results

5. Result

The best accuracy rates of the classification algorithms achieved with the tests on WEKA, Knime, Orange and Tanagra using Vehicle Evaluation Data Set is shown in Chart 1.

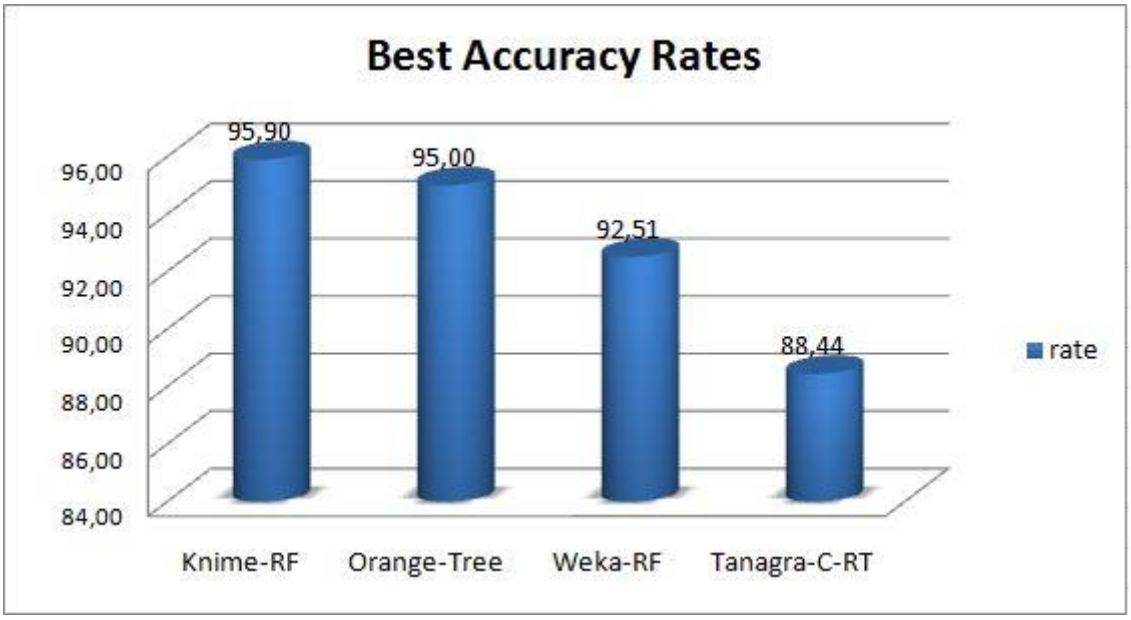

Chart 1. Best accuracy rates in the study

As can be seen from Chart 1 the best accuracy rate achieved was 95.90% with that of KNIME software's Random Forest Algorithm which was then followed by Orange's Tree algorithm, WEKA's Random Forest Algorithm and Tanagra's C-RT algorithm. It can be seen that when the algorithms' results were compared irrespective of the softwares used, the best result for the accuracy rate is achieved with Random Forest algorithm. All the softwares used in this study except Tanagra yielded results with accuracy rates above 90%. However, all the algorithms run on Tanagra software yielded results with accuracy below 90%. Comparing the results achieved by the softwares, we can say that the best results achieved were produced by KNIME software and the worst results were produced by

the Tanagra software.

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EVALUATING CARROT AS A FUNCTIONAL FOOD

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Abstract: *Consumers have already tended to choose natural plant crops over processed plant produces, like carrot (Daucus corota L.) which is one the very nitrous horticultural crops enjoyed by all ages. Although carrot is rich in fiber and minerals, it is primarily cherished for high beta-carotene content. Moreover, the root contains some other bioactive compounds including other forms of carotenoids, phenolic compounds, vitamin C and polyactylenes. Carotenoid especially beta-carotenes is known for supplying vitamin A and a strong antioxidant activity. Phenolic compounds present in carrots such as chloregenic acids have also antioxidant activities as well. Carrots contain considerable quantity of ascorbic acid which possesses an antioxidant activity and also takes a part some in biological processes. Carrot roots have polyacetylenes, once viewed as toxicants due to being potent skin sensitizers and irritants, which are neurotoxic at high concentrations, more recently they have been considered bioactive compounds. The phytochemical compounds present in carrots may be used as complementary medicine for the prevention and treatment of a number of diseases and disorders. This review explores some major phytochemicals and their pharmacological features present in carrot roots.*

Key words*: Apiaceae, medicinal plant, Vitamin C, beta-carotene, chlorogenic acids*

1. Introduction

Carrot has been widely cultivated since ancient times, and it is one of the 10 most economically valuable crops in the world [1]. An estimated 43 million ton carrots (combined with turnip) are produced annually worldwide, and China is the largest producer followed by Uzbekistan and Russia [2]. In Turkey, the annual carrot production value is about 570,000 tons, and Konya province is the leading producer (355,652 tons) followed by Ankara (132,880 tons) and Hatay (53,121 tons) [3]. Carrot is taught to be originated from Afghanistan [4]. Modern-day carrots are very different from ancestral ones with reduced bitterness, elevated sweetness, reduced endocarp portion [5]. Orange colored cultivars are widely cultivated around the world, however, red, black, pink, purple, yellow and white colored carrots are cultivated as well. Carrots are used for a broad range of ways including fresh, fired, steamed, blanched, or cooked in stews, soups, cakes, and pies. Moreover, from carrots, juices and baby foods are

prepared. Fresh-cut carrots products such as planed, round and finger (baby or mini carrot) can be found as well.

Carrot is considered as one of the high nutrient quality crops, and therefore, it is consumed by people of all ages. The vegetable is good source of fiber, carbohydrate and some minerals. However, the carrot is famous for its rich beta-carotene content. Due its unique structure consisting of 11 conjugated double bonds and a β-ring at each end of the chain, beta-carotene delivers provitamin A and also carries very powerful antioxidant activity [6]. Other carotenoids found in carrots are alpha-carotene, lutein, zeaxanthin, and lycopene [1]. Besides its rich alfa- and beta-carotene contents, the root contains a wide range of bioactive compounds including chlorogenic acids [7], quercetin, luteolin, kaempferol, myricetin [8], cyaniding, pelargonidin and peonidin [9] as phenolic compounds; Falcarinol, falcarindiol, and falcarindiol-3-acetate [10,11] as polyacetylenes; and vitamin C [12].

This review aims at highlighting carrot root phytochemicals and their health-giving properties.

2. Nutritional value of carrots

Usually orange-colored carrots have been used for quantifying nutritional value of carrots. Carrot roots contain approximately 88% water, 1% protein, 7% carbohydrate, 0.2% fat, and 3% fiber [10]. The carbohydrate part is mainly formed by simple sugars, chiefly sucrose, glucose, and fructose, with a minor amount of starch [7]. The roots are rich in fiber including cellulose (50%), hemicellulose (92%) and lignin (4%) [13]. The vegetable is a good source of minerals such as calcium, magnesium, potassium, phosphorous, sodium, and some other trace minerals [14]. Apart from recognized phytochemicals, carrot carries significant amount of Vitamin C, E, and K, folate and choline [12]. Black carrots have significant amount of water-soluble anthocyanins which are used for natural food colorants as red, purple or blue [15]. Carrot contains more than 90 aromatic compounds that are primarily mono- and sesquiterpenes, which contributes to its characteristic aroma [16, 17] which is savored by not only children by also adults.

3. Carrot phytochemicals

Carotenoids, phenolic compounds including anthocyanins, vitamin C and polyactylenes are the predominant phytochemicals isolated from carrot roots (Tab. 1).

Table 1. Major phytochemicals present in carrot roots

Carotenoids	Alfa-carotenes
	Beta-carotenes
	Lutein
	Beta-cryptoxanthin
	Lycopene
	Zeaxanthin
Phenolics	Chlorogenic acid derivatives
	P-hydroxybenzoic

	Caffeic acid
	Luteolin
	Keampferol
	Myricetin
	Cyaniding
	Pelargonidin
	Peonidin
Polyacetylenes	Falcarinol
	Falcarindiol
	Falcarindiol-3-acetate
Vitamins	Ascorbic acids (Vitamin C)
	Vitamin E
	Vitamin K
	Folate (Vitamin B_1)
	Choline (Vitamin B_4)

The carrot roots contain a very high amount of carotenoids which are considered high-value bioactive compounds known for health-giving properties. Color of the carrot in most cases defines carotenoid types and quantity: for example, orange-colored carrot root possesses high amount of alfa and beta carotene, red-colored carrot ones does high amount of lycopene, and yellow-colored ones does high amount of lutein [18]. Orange-colored cultivars are very rich in carotenoids especially beta-carotene (ca. 8.3 mg 100 g-1 fw) which is the predominant phytochemical present in carrot [19]. Besides beta-carotene, other from carotenoids including alpha-carotene, lutein, zeaxanthin, and lycopene are also found in carrot roots [1].

The leading phenolic compounds present in carrot roots are chlorogenic acids [7] followed by quercetin, luteolin, kaempferol and myricetin [8] as flavonoids; and cyaniding, pelargonidin and peonidin as anthocyanins [9]. Black-colored carrot cultivars bears abundant amount of flavonoids than other cultivars [1, 18]. The predominant chlorogenic acids presented in carrot roots are 5´-caffeoylquinic acid, 3´¬caffeoylquinic acid, 4´-p-coumaroylquinic acid, 3´,4´-dicaffeoylquinic acid, 3´,5´-dicaffeoylquinic acid, and others [20].

Carrots contain considerable quantity of vitamin C (5.9 mg 100 g-1 fw [12]. The Vitamin C quantity found in carrots is higher compared to grapes, nectarines, pears, and plums, among others [1].

Carrot carries another group of phytochemicals called polyacetylenes which are widely distributed in Apiaceae family. Polyacetylenes contribute the bitter flavor formation in carrots. Types of polyacetylens present in carrot roots are falcarinol, falcarindiol, and falcarindiol-3-acetate [10, 11].

4. Pharmacological effects

Carrot root extracts have been reported to have anti-nocceptive, anti-inflammatory, hypoglycaemic, anti-diabetic, antioxidative and anticancer effects [21- 24].

Carrot is the richest beta-carotene source among fruits and vegetables. Beta-carotene is precursor of Vitamin A which is necessary for vision by converting neural transmission of light into vision and for visual dark adaptation [1, 25]. The other important function of Vitamin A includes the control of cellular development and body processes [1]. Vitamin A is converted to a hormone-like molecule retinoic acid which regulates some immune responses through gene expression and transcription [26].

Carotenoids have been clinically studied for an anti-cancer agent and found effective in animal models and in humans. Beta-carotene is a very strong antioxidant compound because of having 11 conjugated double bonds and a β-ring at each end of the chain, which may neutralize free radicals in lipophilic environment including membranes [7]. Extract obtained through hexane from red carrot has been found to have cytotoxic activity against human breast cell lines (MCF-7) [24]. Similarly, ethanol or acetone extracts from black carrot have been shown to have cytotoxic activity against the same cancerous cell lines [25].

Carrots contain another type of carotenoids lutein which implicated in preventing of age related muscular regeneration and reduced risk of atherosclerosis [28].

Carrots own significant antioxidant compounds including carotenoids, phenolics, vitamin C, and tocopherol. Antioxidants protect cells against free radicals generated in cells through metabolic activities or from environmental sources. Free radicals engage with vital biomolecules like lipids, lipids, proteins, or even DNA to start processes which may lead to chronic diseases such as cancer or cardiovascular diseases [1].

Carrots carries Ascobic acid which is well-known its antiscorbutic activity. Ascorbic acid is likely to possess preventative role against some diseases including cancer and cardiovascular diseases [1]. Furthermore, it takes a part of some biological processes including the suppression of enzymatic browning and the formation of nitrosamines, the decline of metallic ions, and the enhancement of the stability and utilization of folic acid and vitamin E [29]. Ascorbic acid also improves the absorption of iron to prevent anemia [30].

Carrots contain a group compounds, polyacetylenes which are widely found in Apiaceae family including falcarinol, falcarindiol, and falcarindiol-3-acetate [10, 11]. Recent in vitro studies indicated that polyacetylenes of carrots possess have anti-inflammatory activity in macrophages, biphasic stimulatory and cytotoxic effects on primary mammary epithelial cells, and cytotoxic activity in some cell lines [7, 31, 32]. Thus, once viewed as toxicants due to being potent skin sensitizers and irritants and are neurotoxic at high concentrations, more recently they have been considered bioactive compounds [10].

Cyanidin 3-xylosyl galactoside anthocyanin extracted from black carrots has been shown to be effective against Type-2 diabetes [33]. The phytochemical inhibits glucose metabolism related enzymes such as alpha-amylase and alpha-glucosidase [33].

Ethanol extracts from black carrot have exhibited an antibacterial activity against food-borne pathogens including *Bacillus cereus* and *Staphylococcus aureus* [17].

5. Conclusion

In this review, we present carrot roots containing some valuable biologically active compounds including carotenoids with provitamin A activity, phenolic compounds, vitamin C and polyactylenes which possessing antioxidant activities and other health-giving effects. Thus, we suggest that

consumption of carrots does increase intake of health promoting phytochemicals end eventually may impede some diseases or disorders associated with these phytochemicals. However, more studies are required for effectiveness and safety of the phytochemicals.

We recommend carrot culture and consume in Turkey should be supported by both government and media. Turkey is one of the rich countries in terms of carrot diversity including varieties, cultivars and genotypes, thus, both universities and research institutes should do more researches on carrots in order not to stay behind other developed countries. We also advice that carrot producers to be more vocal on health promoting effects of carrots, which might result not only an increase in consumption but also revenue.

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