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EVALUATION OF AN INTERCROPPING SYSTEM: LETTUCE AND RADISH GROWING IN FRUIT SAPLING PRODUCTION

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Abstract: Agricultural production is one of the most negatively affected sectors from increasing population and global warming. Increasing food demand along with narrowing agricultural production areas increased the need for sustainable agricultural approaches where the unit area is better utilized. Intercropping systems are of those approaches based on the principle of growing more than one crop in the same area. In this study, it was aimed to analyze the opportunities of increasing land-use efficiency in open field fruit sapling production. For this aim, lettuce and radish were grown on the inter-rows of almond, apple, apricot, cherry, and pear sapling growing lines. When compared with control plants, results indicated a slight negative effect of intercropping systems on sapling quality. Yield and growth characteristics were lower in the vegetables subjected to intercropping. On the other hand, Land Equivalent Ratio (LER) and Net Economic Profit (NEP) were higher in intercropping systems. LER value varied between 1.86 and 1.97, and NEP value between 3328 and 6962 USD/da. These results indicated that land-use efficiency was increased with the examined intercropping systems. As a result of the study notwithstanding the quality and yield loses, it was concluded that intercropping of lettuce and radish in fruit sapling production is a beneficial growing application for the mentioned aims.

Keywords: Sapling growing, Intercropping, Land use, Sustainable agriculture, Vegetable growing

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1. Introduction

The main goal of agricultural production is to achieve high yield and quality products at the lowest possible cost. There are different ways of reducing costs in agricultural production, such as using less inputs or using lower-cost inputs. The best use of the unit area is also important in reducing costs in agricultural production. Thus, in spite of the increasing population in the world, the limited possibilities of increasing agricultural production areas reveal the importance of the issue. Additionally, global warming and consequently occurring climate change constitutes another restricting factor on agricultural production that compels to produce more with less together with sustainable agriculture approaches.

The yield obtained from the unit area can be increased by growing more than one crop species in the same area in one year, depending on the ecological conditions. Intercropping idea was put forward in this context and is defined as cultivating more than one plant species in the same area simultaneously (Midmore, 1993). Intercropping applications have been successfully implemented in different ways with different plant species, so that better utilization of the unit area and more efficient use of inputs such as water and fertilizer have been possible to generate higher income (Li et al., 1999). Furthermore, the control of biotic factors such as diseases, pests and weeds in the intercropping production system can be performed more effectively (Theunnissien, 1997; Baumann et al. 2001). In addition, the overall yield and net income from intercropping generally increases in comparison to normal cultivation, and the risk of yield loss or price fluctuations of one species can be compensated by the yield from other product or products (Nissen et al., 2001, Ojeifo et al., 2007a). In addition, it contributes to the reduction of erosion as a result of a more intensive plant cover (Zimmermann, 1996; Nissen et al., 2001). In intercropping systems, in order to achieve these advantages, it is necessary to choose the correct combinations of species and varieties (Hauggaard-Nielsen and Jensen, 2001). In this sense, it is important to consider the morphological properties, nutrient requirements and chemical interactions (allelopathy) of the plants to be selected (Davis and Wolley, 1993).

Fruit sapling production is a two-year activity without any income till the end and this poses a significant disadvantage in terms of sapling cost. Therefore, the possibilities of intercropping application for the evaluation of the land by earning income during this period, which requires a long process for sapling producers, were investigated in some limited previous studies conducted to determine the applicability of intercropping systems for better evaluation of the area by earning income during the sampling production period. Chifflot et al. (2006) indicated that the intercropping system of cherry and walnut saplings and wheat, barley and sunflower had positive effects on stem diameter, shoot height and stem volume index of saplings. Ojeifo et al. (2007a) cultivated watermelon among the mandarin saplings and at the end of the research stated that the intercropping system significantly increases the income. In another study conducted by the researchers, melons were cultivated among the saplings and obtained similar positive results (Ojeifo et al., 2007b). Karlıdağ and Yıldırım (2009a) cultivated lettuce and radish in apricot and cherry sapling production and reported that more income could be obtained from the unit area with this system. Song et al. (2020) have grown sweet potatoes among walnut saplings and similarly reported positive results.

In this study, the possibilities of obtaining the mentioned advantages of intercropping during the saplings production of different fruit species were investigated. For this purpose, saplings belonging to five different fruit species were produced and lettuce and radish were grown among the saplings in two years of production. The obtained results were of guidance for the producers of saplings of the mentioned fruit species.

2. Material and Methods

This study was conducted in research fields of Malatya Turgut Özal University located in Battalgazi district of Malatya in Türkiye (N 38°27'56.12", E 38°21'29.05", 721 m above sea level). The climate of the study area is characterized with hot and dry summer, and cold and long winter periods. The mean temperature ranges between -3.4 and 33.9 °C and mean annual precipitation is 376 mm in the area (MGM, 2020). The climatic conditions were in normal ranges of the experimental area during the study (Table 1).

Table 1. Meteorological data of the experimental area recorded during the study

	Months									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
	2017									
MT	0	2.9	8.9	12.6	17.7	24.7	29.6	30.3	23.5	14.2
MMT	5.8	10.3	16.5	20.4	25.5	32.6	37.7	37.8	34.5	23.1
MNT	-5.2	-6.1	0.8	4.3	9.5	13.9	17.1	17.2	11.5	5.4
	2018									
MT	4.2	6.35	11.5	15.1	18.9	23.7	27.7	28.1	22.4	15.5
MMT	9.5	12.7	18.9	25.1	26.8	33.1	37.6	37.0	29.4	21.3
MNT	-1.1	0.0	4.2	5.2	11.1	14.4	17.8	19.2	15.5	9.9

MT= mean temperature, MMT= maximum temperature, MNT= minimum temperature.

As part of the study, fruit saplings of almond, apple, apricot, cherry, and pear were produced between the years of 2016 and 2018. Radish and lettuce were grown between the produced saplings in 2017 and 2018. Sapling production process was started by sowing the rootstock seeds of almond (*Prunus dulcis* var. amara) and apricot (wild bitter common apricot, *Prunus armenica* L.) in November 2016. The clonal rootstocks of 'MM-106', 'OHF-333', and 'MaxMa 14' were used for apple, pear, and cherry saplings, respectively. Clonal rootstocks were obtained from commercial rootstock sapling producer companies and planted in March 2017. Grown rootstocks were grafted in September 2017, and the cultivars grafted on almond, apple, apricot, cherry, and pear rootstocks were 'Ferragnes', 'Fuji Kuki', 'Hacıhaliloğlu', '0900 Ziraat', and 'Santa Maria', respectively. The saplings were planted at 110 cm × 25 cm spacing (3636 saplings/da). 'Adranita' lettuce (*Lactuca sativa* L. var. Longifolia) and 'Cherry Bella' radish (*Raphanus sativus* L.) cultivars were the vegetable materials grown on a single line (intrarow spacing of 10 cm for radish and 25 cm for lettuce) at the center of inter space of sapling lines. Control plots of vegetables were planted in recommended grid, 30 × 30 cm for lettuce, and 15 × 5 cm for radish (Günay, 1992; Günay, 1993). In both years of fruit sapling production, the vegetables were grown in the autumn season (harvest mid-November).

Irrigation and fertigation was carried out via drip irrigation. There was no serious drought and nutrient deficiency that would disturb the experiment observed. Weed control was carried out in the form of hoeing and no pesticides applied.

In two consequent study years, heights (cm) and stem diameters (mm) of the saplings measured at 5 cm above the budding union via digital calipers. Similarly, some physical but also some chemical assessments were performed in lettuce and radish plants in both years of the study. As part of physical properties which were measured by using precision scales, tape line and digital calipers; plant weight (g), plant height (cm), stem diameter (mm), stem length (mm), head diameter (cm) were measured in lettuce plants. The growth parameters of radish were root weight (g), root length (cm), root diameter (cm), plant weight (kg) (whole plant weight including root and leaves), and dry matter (%) which were calculated according to the ratio of fresh root weight and dry root weight after drying of radish root samples in drying oven at 65 °C until the weight was fixed. In both lettuce leaf and radish root juice samples; pH, Total Soluble Solids (TSS) (%), Titratable Acidity (TA) (%), and TSS/TA values were detected. The pH value of juice samples were measured by using digital pH meter (Hanna HI99141) and TSS were determined via hand refractometer (ATC 0-32). Titratable Acidity (TA) was measured according to Haffner and Vestrheim (1997). TSS/TA value, an important index of taste, was calculated according to the ratio of TSS and TA values (Ledbetter et al., 2006).

In order to determine the effectiveness of intercropping systems in terms of unit area usage, Land Equivalent Ratio (LER) was calculated for each treatment combination according to below formula (Vandermeer, 1989). In the formula; A represents the main crop and B is the intercropped crop. I and S indicate the yield of main (AI and AS) or intercropped crop (BI and BS) under intercropping system or sole-cropping. Since the yield of sapling was not depended on intercropping, the ratio of AI/AS was accepted as “1” in the calculation of LER value (Equation 1) (Ojofo et al., 2007b).

Additionally, Net Economic Profit (NEP) (USD/da) value (Equation 2) was calculated to determine the profitability of the applied intercropping systems according to the below formula (Miller, 1982; Karagölge, 1996). Production Value (PV) was calculated by multiplication of yield and unit price of the obtained products (vegetables and saplings) in the study area at the harvest.

$$LER = \frac{AI}{AS} + \frac{BI}{BS} \quad (1)$$

$$NEP = PV - (\mathrm{DC} - \mathrm{IDC}) \quad (2)$$

The experiment was conducted according to random block design in four replicates. Obtained results were statistically analyzed according to Duncan’s Multiple Range Test using SPSS 23.0 for Windows. Variations and differences among treatments were determined at the $P \leq 0.05$ significance level.

3. Results

3.1. Sapling Quality Evaluations

The effects of different intercropping systems on the diameter and length of the saplings are given in Table 2. When the table is analyzed, it can be seen that intercropping significantly affected the height of apple and pear saplings, but not the height of apricot, cherry and almond saplings in the first year of the study. The height of the apple saplings varied between 118.7 and 130.7 cm and especially the combination with radish decreased the height of apple saplings. In the intercropping combination made with lettuce, the average apple sapling height was determined as 128.8 cm, but it was concluded that the difference was not significant compared to the control group seedlings. Similarly, the length of pear saplings was measured between 122.2 and 130 cm, and it was found that the intercropping system with both species significantly reduced the pear sapling lengths compared to the control. In the same study year, the stem diameter values of the seedlings belonging to any species were not affected by their breeding systems together.

When the results obtained from the second trial year are analyzed, it can be seen that the lengths of the saplings of all species are affected by the intercropping systems evaluated.

Table 2. Height and stem diameter results of intercropped saplings under different intercropping combinations*

Intercropping Combination		Sapling Height (cm)		Stem Diameter (cm)	
		2017	2018	2017	2018
Almond	Control	99.9	167.3^{a}	1.11	1.50^{a}
	Lettuce	96.5	142.8^{b}	1.07	1.23^{b}
	Radish	93.7	145.4^{b}	1.01	1.31^{b}
Apple	Control	130.7^{a}	168.0^{a}	1.53	1.66^{a}
	Lettuce	128.8^{a}	159.6^{b}	1.51	1.61^{ab}
	Radish	118.7^{b}	161.4^{b}	1.48	1.51^{b}
Apricot	Control	159.4	197.2^{a}	1.36	1.62
	Lettuce	156.2	168.0^{b}	1.24	1.60
	Radish	155.1	165.5^{b}	1.33	1.59
Cherry	Control	161.6	177.6^{a}	1.19	1.71
	Lettuce	158.6	161.6^{b}	1.15	1.65
	Radish	157.8	168.5^{b}	1.14	1.68
Pear	Control	130.0^{a}	191.2^{a}	1.19	1.61^{a}
	Lettuce	122.2^{b}	165.9^{b}	1.12	1.46^{b}
	Radish	128.9^{b}	178.5^{b}	1.17	1.41^{b}

^{a,b}Differences among the values of a particular character and year signed with different letters are significant at $P \leq 0.05$, *years were evaluated separately.

The average height of saplings was measured between 142.8 and 167.3 cm, 159.6 and 168.9 cm, 165.5 and 197.2 cm, 161.5 and 177.6 cm, 165.9 and 191.2 cm for almond, apple, apricot, cherry and pear saplings. Regardless of the species and the plants grown together, sapling height was affected negatively from different plant combinations. Stem diameter values of almond, apple, and pear seedlings varied between 1.41 and 1.61 cm, 1.61 and 1.66 cm, and 1.23 and 1.50 mm, respectively, and were significantly affected by intercropping systems. On the other hand, the diameter values of apricot and cherry saplings were not significantly changed when compared to control saplings.

Even though there were some decreases in sapling height and stem diameter in the intercropping combinations when compared to sole-cropping control lines, overall quality of the obtained saplings at the end of the study was not significantly different as no price difference were occurred during sales of the obtained saplings.

3.2. Vegetable Yield and Quality Evaluations

The yield values of lettuce and radishes grown between the sapling rows of different species are shown in Table 3. When the table is examined, it can be understood that the yield values of both lettuce and radish plants were significantly affected by the intercropping systems in both trial years.

In the first study year lettuce yield values ranged from 2.78 to 3.29 kg/m^2. The highest yield was obtained from sole-cropping plants, while the lowest was obtained from plants grown among pear seedlings. In the second year, the highest lettuce yield which was 2.92 kg/m^2 in average obtained from the control plants and the lowest value was obtained from the plants grown with apple saplings with 2.47 kg/m^2.

When the data of the first year of the radish plants in the table are examined, it is seen that the values varied between 1.44 and 1.60 kg/m^2. The highest value was obtained from the radishes solely grown and the lowest value was obtained from the plants grown among apple trees. The highest yield value for radish in the second trial year was obtained from the control group with 1.24 kg/m^2 and the lowest value was obtained from the plants grown among apple trees with 1.12 kg/m^2.

Data showing the physical properties of lettuce and radishes subjected to different intercropping combinations are presented in Table 4 and Table 5, respectively. Results indicated that the vegetables subjected to intercropping presented worse results in most of the physical characteristics when compared to control plants. On the other hand, there was no significant difference in chemical parameters in both of the study year. For that reason, the results of the chemical parameters are not presented.

Table 3. The effects of different intercropping combinations on lettuce and radish yield*

Intercropping Combination		Yield (kg/m^2)	
		2017	2018
Lettuce	Control	3.29 ^{a}	2.92 ^{a}
	Almond	3.19 ^{ab}	2.57 ^{c}
	Apple	2.89 ^{c}	2.47 ^{d}
	Apricot	3.09 ^{b}	2.52 ^{c}
	Cherry	2.84 ^{c}	2.84 ^{b}
	Pear	2.78 ^{d}	2.75 ^{b}
Radish	Control	1.60 ^{a}	1.24 ^{a}
	Almond	1.53 ^{ab}	1.20 ^{ab}
	Apple	1.47 ^{b}	1.12 ^{b}
	Apricot	1.55 ^{ab}	1.17 ^{b}
	Cherry	1.44 ^{b}	1.14 ^{b}
	Pear	1.51 ^{ab}	1.19 ^{ab}

^{a,b}Differences among the values of a particular character and year* signed with different letters are significant at P≤0.05, *years were evaluated separately.

Table 4. Growth characteristics of intercropped lettuce as affected by different main crops*

Main Crop	Plant Weight (g)		Plant Height (cm)		Stem Diameter (mm)		Stem Length (mm)		Head Diameter (cm)	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	1048.4 ^{a}	931.0 ^{a}	32.9 ^{b}	29.2	53.6 ^{a}	44.3 ^{a}	47.3 ^{c}	42.0 ^{c}	10.5	9.3 ^{d}
Almond	1029.2 ^{a}	913.9 ^{a}	34.1 ^{a}	30.3	42.0 ^{b}	37.3 ^{b}	85.9 ^{b}	76.3 ^{b}	15.1	13.4 ^{a}
Apple	654.0 ^{d}	580.7 ^{c}	33.5 ^{a}	29.7	32.5 ^{cd}	28.9 ^{d}	89.3 ^{b}	79.3 ^{b}	12.2	10.8 ^{c}
Apricot	560.0 ^{e}	497.3 ^{d}	33.8 ^{a}	30.1	28.3 ^{d}	25.1 ^{d}	92.4 ^{a}	82.0 ^{a}	14.3	12.7 ^{b}
Cherry	912.5 ^{b}	810.3 ^{b}	34.5 ^{a}	30.7	35.9 ^{c}	31.8 ^{c}	92.5 ^{a}	82.2 ^{a}	14.8	13.1 ^{a}
Pear	931.7 ^{c}	827.4 ^{ab}	33.7 ^{a}	29.9	37.8 ^{c}	33.6 ^{bc}	87.7 ^{b}	77.9 ^{b}	14.2	12.6 ^{b}

^{a,b}Significant differences (P<0.05) are indicated by different letters, *years were evaluated separately.

Table 5. Physical assessment results of intercropped radish samples as affected by different main crops

Main Crop	Root Weight (g/plant)		Root Length (cm)		Root Diameter (cm)		Plant Weight (g/plant)		Dry Matter (%)	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	200.1 [a]	177.7 [a]	7.71 [a]	6.85 [a]	6.80 [a]	6.04 [a]	6.5 [ab]	5.8 [ab]	3.77 [b]	6.04 [a]
Almond	213.2 [a]	189.3 [a]	7.79 [a]	6.92 [a]	6.98 [a]	6.20 [a]	6.0 [b]	5.3 [b]	3.19 [c]	6.20 [a]
Apple	109.4 [d]	97.1 [d]	6.22 [b]	5.52 [c]	5.37 [c]	4.77 [c]	4.9 [c]	4.5 [c]	3.79 [b]	4.77 [c]
Apricot	82.8 [e]	73.6 [e]	5.55 [c]	4.93 [d]	4.77 [d]	4.24 [c]	4.7 [c]	4.6 [c]	4.52 [a]	4.24 [c]
Cherry	148.7 [c]	132.1 [c]	6.94 [b]	6.16 [b]	6.17 [b]	5.48 [b]	6.1 [b]	5.4 [b]	3.07 [c]	5.48 [b]
Pear	169.9 [b]	150.8 [b]	7.37 [a]	6.54 [ab]	6.49 [b]	5.76 [b]	7.4 [a]	6.5 [a]	2.97 [d]	5.76 [b]

Significant differences (P<0.05) are indicated by different letters, *= years were evaluated separately.

3.3. LER and NEP Results

Table 6 presents the LER results calculated for different intercropping combinations. The highest LER value was obtained from the almond seedlings and radish plants (1.97). The lowest value was obtained with the combination of apple saplings and lettuce with 1.86. LER values of other intercropping systems varied between 1.89 and 1.96.

Table 6. Land Equivalent Ratio (LER) and Net Economic Profit (NEP) values in different sapling+vegetable intercropping systems

Intercropping Combination		LER	NEP (USD/da)
Almond	Sole	1.00[d]	3328[f]
	Lettuce	1.93[ab]	4409[ef]
	Radish	1.97[a]	4055[e]
Apple	Sole	1.00[d]	5624[b]
	Lettuce	1.86[b]	6962[a]
	Radish	1.92[ab]	6275[ab]
Apricot	Sole	1.00[d]	4509[def]
	Lettuce	1.90[ab]	5878[ab]
	Radish	1.96[a]	5201[b]
Cherry	Sole	1.00[d]	5191[bc]
	Lettuce	1.92[ab]	6349[ab]
	Radish	1.91[ab]	5901[ab]
Pear	Sole	1.00[d]	4759[d]
	Lettuce	1.89[ab]	5941[ab]
	Radish	1.95[ab]	5543[b]

[a,b]Significant differences (P < 0.05) are indicated by different letters.

4. Discussion

When the results of the saplings subjected to both sole-cropping and intercropping are examined, it can be observed that the length of the saplings was negatively affected especially in the second year of the study in both the lettuce and the radish grown saplings. Similarly, although the sapling diameter was not negatively affected in the first year of the study, in the second year it decreased in almond, apple and pear saplings with intercropping.

Findings reported in previous studies were mostly different in terms of quality of saplings. Chifflot et al. (2006) found that wheat, barley and sunflower cultivation among cherry and walnut saplings had a positive effect on sapling diameter, shoot length and stem volume index in saplings. Similarly, Ojeifo et al (2007a, 2007b) reported that intercropping of melon and watermelon with mandarin saplings do not have a negative effect on plant growth in saplings or even positively affect them. Karlıdağ and Yıldırım (2009b) also stated that lettuce and radish grown between apricot and cherry sapling production rows do not have a negative effect on seedling height and stem diameter. The main reason of the emergence of a different result in this study compared to previous studies would be the differences in cultivars and planting intervals. Nevertheless, the quality changes in the saplings that were subjected to intercropping were limited, and were not at a level that would affect the general quality of the seedlings and therefore the sales price. As a matter of fact, the obtained NEP results confirmed this situation. Additionally, higher LER values were obtained from all intercropping applications when compared with sole-cropping. Both NEP and LER results were in accordance with the results reported by Karlıdağ and Yıldırım (2007), Karlıdağ and Yıldırım (2009a, 2009b).

The fact that the LER value is greater than 1 indicates that intercropping is more effective in terms of yield and land use than sole-cropping; adversely LER value is less than 1 means that intercropping is less effective than sole-cropping (Vandermeer, 1989). It has been reported that this situation caused by more efficient use of resources such as light, plant nutrient and water in the unit area compared to sole-cropping in intercropping practices consisting of plants with different morphological structure and development time (Ojeifo ve ark., 2007a, 2007b). Tripati et al (2019) reported that in the intercropping of some medicinal-aromatic plants with peach trees, the fruit yield increased in the trees subjected to intercropping compared to the control plants, and the income from the unit area increased with the grown medicinal-aromatic plants. In another study, intercropping of watermelon and melon with mandarin saplings was tried and it was reported that it significantly increased the income obtained from the intercropping unit area (Ojeifo et al. 2007a, b). Song et al. (2020) reported similar findings in their study conducted on intercropping of sweet potato with walnut saplings.

When the obtained vegetable yield results are analyzed, significant yield decreases were observed in most of the intercropping applications compared to control plants especially in the second year of the study, but also in the first year. Similarly, in a general point of view, almost all values of plant characteristics decreased in both radish and lettuce plants subjected to intercropping compared to control. Besides plant and stem height values of lettuce were higher in intercropping applications. Similar results were also reported by Karlıdağ and Yıldırım (2009a), and this is thought to have occurred as a result of the shading effect of the saplings. The effects were relatively lower in vegetables grown with almond saplings. This was probably due to the relatively shorter length of the almond seedlings and the smaller shading effect due to the smaller canopy volume.

In intercropping systems consisting of different underground and aboveground structures, cross-species competition for light and ground resources may decrease or disappear altogether. It has been suggested that intercropping systems occupy a wider soil area because of the different root structures of the species that make up the system compared to sole-cropping and they need more resources at different times, and therefore they benefit from soil resources such as plant nutrients and water more effectively (Francis, 1989; Woolley and Davis, 1991; Morris and Garrity, 1993).

Likewise, in intercropping systems consisting of plant species having different growth rates and periods of demand to growth resources, the resources are used in the best way, so land-use efficiencies are very high (Fukai and Trenbath, 1993). As a matter of fact, the growth and development of the saplings towards the autumn slow down and the amount of used resources also decreases which provided a more suitable environment for vegetable growth in the intercropping systems examined within the scope of the study.

5. Conclusion

Sapling production is an important and sensitive field of agricultural production because of the influence the orchard quality by which they are planted. On the other hand, especially open field sapling production takes two years of production without any income until the end of the production period. Besides, increasing population required increasing amounts of food supply. For all those reasons, this study was conducted to evaluate the efficiency of growing lettuce and radish in the sapling production parcels. In order to determine the efficiency of assessed intercropping systems sapling and vegetable quality attributes, LER and NEP values were compared with sole-cropping control plants. Results indicated significant yield and physical quality decreases in vegetables together with no effect on chemical attributes. Sapling height and stem diameter slightly decreased in some of the combinations, whereas this was not found significant on overall sapling quality. Thus, LER and NEP values were significantly increased by the intercropping systems applied as part of the study. As a result of the study it was concluded that intercropping of lettuce and radish in fruit sapling production would be beneficial for sapling producers and for increasing the food supply.

Author Contributions

H.K. (100%) designed the study and set up the trials. H.K. (20%), İ.K.K. (20%), F.E.K. (20%), R.K. (20%) and T.K. (20%) conducted the study. H.K. (34%), İ.K.K. (33%) and F.E.K. (33%) analyzed the data. F.E.K. (34%), İ.K.K. (33%) and H.K. (33%) wrote the manuscript. All authors reviewed and approved final version of the manuscript.

Conflict of Interest

The authors declared that there is no conflict of interest.

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