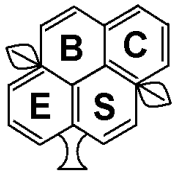

Journal

EFFECT OF GARLIC AND ONION EXTRACTS AS APREHARVEST APPLICATIONS ON THE POSTHARVEST QUALITY AND OXIDATIVE ENZYME ACTIVITY OF PEARFRUIT DURING COLD STORAGE

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ABSTRACT

There is a continuous need to look for alternative and safe natural sources of plants. Chemical compounds are highly polluting, dangerous and more expensive. As medicinal plants play a role in inhibition of cellular oxidation reactions and pathogens that infect plants. Here, it is important to find plant sources as nutrients and antimicrobial. Pear is one of the favorite fruits in the temperate climate zone. The study was conducted during two seasons on 8 years old Le-Conte pear trees (*Pyrus communis*) budded on (*Pyrus betulaefolia*). Nineteen treatments, including the control sprayed three times with successive extracts (Hexane, ethanol and water) from garlic and onions at 10, 15 and 20% concentrations were applied firstly at 50% of bloom, then the second time was after full fruit set and the third one after month of full fruit set of cold storage which show that the use of 20% hexane extract of garlic or onion enhanced fruit quality by giving the lowest value of decay % ;loss in fruit weight; Total soluble pectin ; the activity of pectinase, peroxidase and polyphenol oxidase and the highest value of firmness ; total phenols compared

with control . The studies recommend spraying hexane extract of garlic or onion as natural product to extend keeping quality of pear fruits.

Key words*: cold storage, garlic, onion extracts, Postharvest, Pear, quality.*

INTRODUCTION

Pear is one of the favorite fruits in the temperate climate zone. It is considered the third deciduous fruits in the worldwide and it is also the fourth fruit among all fruit crops in distribution through the global market **(FAOSTAT, 2011).**Pear cultivar is grown in Egypt, however, the total cultivated area of pears fluctuated sharply during the last decades due to fire blight in fection in 2011. Pears fruit is an excellent source of vitamin C, less allergenic than many other fruits and its juice is sometimes used as the first juice introduced to infants **(Vadivel and Janardhanam, 2005)**.

The World has become aware of the environment2al issue in recent years. Synthetic compounds are highly polluting, hazardous and much more costly. Researchers are working in the field of natural products extensively as they are less hazardous, low cost and easily available **(Phiri, 2010).** Thus, there is a continuous need to search for alternative safe natural sources of plant nutrients, natural growth regulators even for protecting against disease and insects **(Prosecus, 2006).**

Pre harvest conditions can have a great impact on fruit quality attributes and postharvest responses. Firmness is an important quality attribute in pear, and excessive softening increases susceptibility to bruising and decay, thus limiting fruit postharvest life **(Raffo*et al.*, 2011)**.Many medicinal plants produce antioxidant and antimicrobial properties which protect the host from cellular oxidation reactions and other pathogens highlighting the importance of the search for natural antimicrobial drugs **(Mothana and Lindequist, 2005; Bajpai*et al.*, 2005** and **Wojdylo*et al.*, 2007).** Recently, public health and environmental safety encourage the use of plant extracts for improving growth, nutritional status, the productivity of fruit crops and fruit keeping quality **(Ammon and Wahl, 1991** and **Nijjar, 1985)**. Garlic;*Alliumsativum* and onion;*Alliumcepa* are members of the lily family. Their Pungent flavor derived from number of volatile

many antioxidants; i.e. organosulfur compounds such as allylcysteine, allinin, diallydisulfide, diallysulfideajoene and allicin **(McCallum *et al.*, 2005** and **Kumar and Berwal,1998)**. These compounds had an antioxidative, antibacterial, antiviral and antifungal effect, also the ability to scavenge reactive oxygen species and inhibit the formation of lipid peroxidation by antioxidant action (**Borek, 2001;Amagase, 2006** and **Yokoya and Handro, 1997)**.

Handling carefully while picking and storing, internal browning and soft spots are the main problems with pears.The shelf life of pear fruit is very short and it is susceptible to decay, mechanical damage, and moisture and nutritional losses during storage **(Nath, *et al.*,2012)** Postharvest oxidative stress occurs during fruit storage, causing an imbalance between the production and removal of reactive oxygen species (ROS), such as H_2O_2 and O_2^- from the tissues. The protection of fruit cells from oxidative injury depends on the level of antioxidant enzymes which scavenge ROS and prevent harmful effects **(Mittler, 2002** and **Zeng*et al.*, 2010)**. In addition, peroxidase activity which involved in different aspects related to growth, such as auxin catabolism, ethylene biosynthesis and cell wall lignification could be altered or inhibited by an excess of H_2O_2 (**Yokoya and Handro, 1997).**Therefore**,** the main objective of the current study is to extend cold storage period and keeping the quality of pear fruits by using onion and garlic extracts as antioxidative stress agent during storage for 75 days in order to extend the fruits shelf-life.

MATERIALS AND METHODS

The present study was carried out at Fruit handling Department, Horticulture Research Institute, Agricultural Research Center, Giza, Egypt during the two seasons 2016 and 2017 on eight years old "Le-Conte" Pear trees (*Pyruscommunis*) budded on (*Pyrusbetulaefolia*). Nineteen treatments including control, each treatment contain 3 replicates sprayed three times with different successive extracts10, 15 and 20%. Treatments (by extracts 10, 15 or 20% of each extract) were applied firstly at 50% bloom, then the second time was after full fruit set and the third one after one month of full fruit set.

Plant materials:

Fresh mature garlic cloves and onion bulbs were obtained from Medicinal and Aromatic Plants Department, Horticulture Research Institute, Agricultural Research Center.

Preparation of extracts:

Fresh mature garlic cloves and onion bulbs were ground then the extraction of active constituents was carried out using different successive solvents (hexane, ethanol and water). These extracts were evaporated under reduced pressure to obtain a constant weight, after that Dilution was prepared at concentrations of 10, 15 and 20 %of each extract.

Fruit keeping quality:

Mature Pear fruit was picked; the fruits were cleaned, packed in perforated carton boxes each of 30 fruit (9 boxes as for each treatment ; three for decay ; three for weight loss and three for chemical analysis) each box consider as a replicate stored under cold storage (at 0° C and 95-98% R.H).

In each treatment, different measurements were carried out starting from zero time of storage and continued at intervals of 15 days, until the percentage of fruit decay attained about 50%.

Fruit decay (%):

Fruits which were decayed by different physiological and pathological factors were periodically counted and discarded, and then the percentage of fruit decay was calculated in relation to the total number of fruits.

The loss in fruit weight (%):

Fruits were periodically weighed and loss in fruit weight was recorded for each replicate and then was calculated as percentages in relation to the fruits weight at zero time of storage.

Firmness:

Fruit firmness as (lb/In^2) in two sides of fruits was measured by using a pressure tester (Mecmesin Advanced Force Gauga 250N, EU).

Total phenols content:

Determination of phenol compounds was conducted according to the method described by **Daniel and George(1972)**.

Total soluble pectin content:

Total soluble pectin was determined according to **Dietz and Rouse (1953).**

Pectinase activity:

Enzyme assay was determined (unit per gram fresh weight) according to **Reddy and Sreeramulu (2012)**.

Peroxidase activity:

The enzyme activity was expressed as changes in absorbance unit per gram fresh weight according to **Reuveni *et al.* (1992)**.

Polyphenol oxidase (PPO) activity:

Polyphenol oxidase enzyme activity was assayed (unit per gram fresh weight) by using photochemical method as described by **Chance and Maehly (1995)**.

Statistical analysis:

Data for the physical and chemical characteristics were subjected to analysis of variance (ANOVA) and the least significant difference (L.S.D. at 5% level) was also adopted according to **Gomez and Gomez (1984)**.

RESULTS AND DISCUSSION

Physical characteristics:

Fruit Decay %:

Tables (1 and 2) illustrate the effect of using onion or garlic extracts on the decay of pear fruits under storage conditions. The result concerning the highest decay percentage was noticed in the control treatment after 75 days in the first and second seasons (50.2 and53.23%), respectively. However, the lowest decay % is shown with the use of 20% hexane extract of garlic in the second season which was 24.32% after 75 days followed by the Hexane extract of onion at (20%) concentration after 75 days of cold storage in both seasons. These results are in line with those obtained by **Kamel (2014)** on Valencia orange fruits and **Mahmoud (2016)** in apple fruits; **Abd El-Razek *et al.* (2011)** on apricot fruits and **Abd El-Razek *et al*. (2013)** on *'Le Conte'*pearasthey found that treated trees with onion or garlic extract improved keeping quality of fruits. This reduction in weight loss affecting treating by garlic oil it may be

due to the effects of oil as permeable barrier against oxygen, carbon dioxide and moisture, thereby reducing respiration, water loss and oxidation reaction rates (**Baldwin *et al.*, 1999** and **Park, 1999)**. Decreasing in fruit decay as affected by treatment of garlic oil may be due to the antifungal activity of garlic which is attributed to the main biologically active component such as Allicin **(Jirovetz *et al.*, 2002)**.

Table (1): Effect of garlic and onion different extracts on Decay (%) of pear fruits stored at 0°C in the first season (2016)

Treatments (A)		First season 2016						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	0.00	9.77	20.80	30.16	45.17	55.20	**26.85**
Garlic	Hexane ext. 10%	0.00	0.00	4.74	10.05	18.96	25.25	**9.83**
	Hexane ext. 15%	0.00	0.00	4.80	9.95	17.23	25.13	**9.52**
	Hexane ext. 20%	0.00	0.00	4.74	9.07	15.27	24.99	**9.01**
	Alcohol ext. after Hexane ext. 10%	0.00	0.00	4.87	14.95	30.16	39.95	**14.99**
	Alcohol ext .after Hexane ext.15%	0.00	0.00	9.67	15.13	25.09	40.21	**15.02**
	Alcohol ext. after Hexane ext.20%	0.00	0.00	9.68	20.33	34.77	45.16	**18.32**
	Water ext. after Alcohol ext.10%	0.00	0.00	9.67	20.34	29.94	45.23	**17.53**
	Water ext. after Alcohol ext.15%	0.00	0.00	9.65	15.17	29.88	44.76	**16.58**
	Water ext. after Alcohol ext.20%	0.00	4.83	11.93	19.80	35.17	44.89	**19.44**
Onion	Hexane ext.10%	0.00	0.00	4.89	10.30	19.93	25.11	**10.04**
	Hexane ext.15%	0.00	0.00	4.84	10.02	19.90	25.06	**9.97**
	Hexane ext.20%	0.00	0.00	4.81	9.97	15.36	25.01	**9.19**
	Alcohol ext. after Hexane ext.10%	0.00	0.00	9.78	15.13	25.31	39.94	**15.03**
	Alcohol ext. after Hexane ext.15%	0.00	0.00	9.81	20.91	35.06	45.11	**18.48**
	Alcohol ext. after Hexane ext.20%	0.00	0.00	9.81	20.12	30.02	45.02	**17.50**
	Water ext. after Alcohol ext.10%	0.00	0.00	9.61	19.99	35.27	44.85	**18.29**
	Water ext. after Alcohol ext.15%	0.00	4.77	15.48	20.31	35.13	45.00	**20.12**
	Water ext. after Alcohol ext.20%	0.00	0.00	9.81	20.01	30.04	44.90	**17.46**
	Mean (B)	**0.00**	**1.02**	**8.92**	**16.41**	**27.77**	**38.46**	
LSD value at % level for		**A=0.19**		**B=0.11**			**A*B=0.46**	

Table (2): Effect of garlic and onion different extracts on Decay (%) of pear fruits stored at 0°C in the second season (2017)

Treatments (A)		Second season 2017						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	0.00	9.97	20.47	29.39	43.68	53.23	**26.12**
Garlic	Hexane ext. 10%	0.00	0.00	5.18	10.24	17.91	24.47	**9.63**
	Hexane ext. 15%	0.00	0.00	5.85	10.15	16.89	24.39	**9.55**
	Hexane ext. 20%	0.00	0.00	5.18	10.25	15.21	24.32	**9.16**
	Alcohol ext. after Hexane ext. 10%	0.00	0.00	5.31	14.91	29.39	38.71	**14.72**
	Alcohol ext .after Hexane ext.15%	0.00	0.00	9.87	15.08	24.56	38.97	**14.75**
	Alcohol ext. after Hexane ext.20%	0.00	0.00	9.89	20.04	33.94	43.68	**17.93**
	Water ext. after Alcohol ext.10%	0.00	0.00	24.55	15.07	24.77	38.70	**17.18**
	Water ext. after Alcohol ext.15%	0.00	0.00	10.01	19.73	29.27	43.43	**17.07**
	Water ext. after Alcohol ext.20%	0.00	5.27	12.03	19.52	34.08	43.42	**19.05**
Onion	Hexane ext.10%	0.00	0.00	5.32	10.47	19.67	24.59	**10.01**
	Hexane ext.15%	0.00	0.00	5.28	10.28	19.62	24.56	**9.96**
	Hexane ext.20%	0.00	0.00	5.26	10.21	15.30	24.51	**9.21**
	Alcohol ext. after Hexane ext.10%	0.00	0.00	9.86	15.11	29.13	43.30	**16.23**
	Alcohol ext. after Hexane ext.15%	0.00	0.00	10.01	20.58	34.35	43.63	**18.10**
	Alcohol ext. after Hexane ext.20%	0.00	0.00	9.88	20.04	29.18	43.74	**17.14**
	Water ext. after Alcohol ext.10%	0.00	0.00	9.82	19.71	34.25	43.38	**17.86**
	Water ext. after Alcohol ext.15%	0.00	5.21	15.41	20.01	34.08	43.53	**19.71**
	Water ext. after Alcohol ext.20%	0.00	0.00	10.01	19.83	29.26	43.54	**17.11**
	Mean (B)	**0.00**	**1.08**	**9.96**	**16.35**	**27.08**	**37.27**	
LSD value at % level for		**A=0.13**		**B=0.07**			**A*B=0.32**	

Loss in fruit weight%:

Results in **Tables (3 and 4)** concluded that the highest weight loss% of pear fruits resulted from the control fruits after 75 days in first and second season (40.39 and 38.95%), respectively. On the contrary, the lowest weight loss % was recorded when using 20% hexane extracts of garlic and onion (15.37 and 15.54in second seasons), respectively.The obtained results are similar to those achieved by **Kamel (2014)** on Valencia orange fruits and **Armanious (2014)** on Thompson seedless grapevines who stated that treatments with onion or garlic extracts decreased weight loss percentage as affected by increasing storage period.

Table (3): Effect of garlic and onion different extracts on weight loss (%) of pear fruits stored at 0°C in first seasons (2016)

Treatments (A)		First season 2016						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	0.00	5.25	11.76	20.57	35.26	40.39	**18.87**
Garlic	Hexane ext. 10%	0.00	3.14	7.23	10.45	13.13	17.83	**8.63**
	Hexane ext. 15%	0.00	2.53	6.84	9.54	13.85	17.52	**8.38**
	Hexane ext. 20%	0.00	2.44	6.53	8.37	11.15	16.10	**7.43**
	Alcohol ext. after Hexane ext. 10%	0.00	3.22	6.82	12.68	19.25	25.44	**11.24**
	Alcohol ext .after Hexane ext.15%	0.00	3.30	6.05	10.55	15.64	27.77	**10.55**
	Alcohol ext. after Hexane ext.20%	0.00	3.04	5.23	8.82	15.67	27.75	**10.09**
	Water ext. after Alcohol ext.10%	0.00	5.44	9.62	16.66	23.44	31.85	**14.50**
	Water ext. after Alcohol ext.15%	0.00	4.65	9.74	15.85	24.73	34.14	**14.85**
	Water ext. after Alcohol ext.20%	0.00	3.53	8.74	16.75	24.25	34.73	**14.67**
Onion	Hexane ext.10%	0.00	2.33	6.54	11.68	16.85	24.45	**10.31**
	Hexane ext.15%	0.00	3.16	7.63	10.24	14.36	20.15	**9.26**
	Hexane ext.20%	0.00	3.22	6.54	10.45	14.05	18.56	**8.80**
	Alcohol ext. after Hexane ext.10%	0.00	2.82	6.60	12.93	21.63	30.64	**12.44**
	Alcohol ext. after Hexane ext.15%	0.00	3.73	8.23	14.65	20.34	29.65	**12.77**
	Alcohol ext. after Hexane ext.20%	0.00	3.43	9.33	14.92	19.54	28.54	**12.63**
	Water ext. after Alcohol ext.10%	0.00	6.92	13.13	22.45	30.40	39.36	**18.71**
	Water ext. after Alcohol ext.15%	0.00	5.56	13.39	22.23	30.32	37.50	**18.17**
	Water ext. after Alcohol ext.20%	0.00	4.25	9.83	15.05	25.04	38.03	**15.37**
	Mean (B)	**0.00**	**3.79**	**8.41**	**13.94**	**20.47**	**28.44**	

LSD value at % level for A=1.39 B=0.77 A*B=3.40

Table (4): Effect of garlic and onion different extracts on weight loss (%) of pear fruits stored at 0°C in second seasons (2017)

Treatments (A)		First season 2017						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	0.00	5.48	11.68	20.06	34.06	38.95	**18.37**
Garlic	Hexane ext. 10%	0.00	3.54	6.71	10.43	13.86	18.16	**8.78**
	Hexane ext. 15%	0.00	3.47	7.37	10.43	12.98	17.46	**8.62**
	Hexane ext. 20%	0.00	2.80	6.69	8.45	11.29	15.37	**7.43**
	Alcohol ext. after Hexane ext. 10%	0.00	3.55	6.98	12.55	18.81	24.70	**11.10**
	Alcohol ext .after Hexane ext.15%	0.00	3.62	6.24	10.52	15.37	26.92	**10.45**
	Alcohol ext. after Hexane ext.20%	0.00	2.70	6.70	11.60	16.52	23.76	**10.21**
	Water ext. after Alcohol ext.10%	0.00	5.66	9.64	16.34	22.80	30.81	**14.21**
	Water ext. after Alcohol ext.15%	0.00	4.90	9.75	15.57	24.03	32.99	**14.54**
	Water ext. after Alcohol ext.20%	0.00	3.84	8.80	16.43	23.57	33.56	**14.37**
Onion	Hexane ext.10%	0.00	2.88	8.42	9.57	13.67	21.94	**9.41**
	Hexane ext.15%	0.00	3.37	5.46	8.88	15.40	17.16	**8.38**
	Hexane ext.20%	0.00	3.48	6.75	9.23	14.15	15.54	**8.19**
	Alcohol ext. after Hexane ext.10%	0.00	3.17	18.89	12.79	21.07	29.65	**14.26**
	Alcohol ext. after Hexane ext.15%	0.00	4.03	8.32	14.42	19.85	28.72	**12.56**
	Alcohol ext. after Hexane ext.20%	0.00	3.74	9.36	14.69	19.09	27.66	**12.42**
	Water ext. after Alcohol ext.10%	0.00	7.07	12.99	21.85	29.43	37.97	**18.22**
	Water ext. after Alcohol ext.15%	0.00	5.77	13.22	21.65	29.35	36.19	**17.70**
	Water ext. after Alcohol ext.20%	0.00	4.52	9.84	14.81	24.32	36.69	**15.03**
	Mean (B)	**0.00**	**4.08**	**9.15**	**13.70**	**19.98**	**27.06**	
LSD value at % level for			A=0.79		B=0.54		A*B=2.37	

Firmness:

Results in **Tables (5 and6)** show that fruit firmness decreased gradually till the end of the cold storage period of pear fruits in both seasons. It can be observed that fruit firmness was increased by foliar spraying with Hexane extract of garlic or onion as compared to other extracts and control. Least significant fruit firmness was attained with control after 75 days of cold storage, while pear fruits resulting from foliar spraying with Hexane extract for each of the onion or garlic plants at the highest concentration of each (20%) resulted in significantly the highest fruit firmness at the end of the cold storage in both seasons. The obtained results are similar to those achieved by **Abd-Allah *et al.* (2012)**on Costata persimmon fruits who stated that, 1% garlic extract had significant increase in firmness that was significantly decreased in related to prolonging the storage period in

both seasons. Also, **Kamel (2014)** on Valencia orange fruits and **Mahmoud (2016)** on apple fruits showed that extracts of garlic and onion on apple fruits enhance firmness.Decreasing firmness may be due to pectin which is the most abundant polymer in the middle lamella, and it regulates intercellular adhesion **(Willats *et al.*, 2001)**, but primary fruit cell walls are also rich in polyuronides, accounting for up to 60% of cell wall mass in many fruits **(Redgwell *et al.*,1997)**.

Table (5): Effect of garlic and onion different extracts on Firmness (%) of pear fruits stored at 0°C in the first season (2016)

Treatments (A)		First season 2016						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	15.40	13.90	10.70	8.30	6.10	3.23	**9.61**
Garlic	Hexane ext. 10%	19.10	17.50	15.20	12.40	10.20	7.29	**13.62**
	Hexane ext. 15%	19.90	18.00	15.30	13.70	10.90	7.33	**14.19**
	Hexane ext. 20%	19.90	18.10	15.30	14.30	11.20	7.84	**14.44**
	Alcohol ext. after Hexane ext. 10%	18.50	16.30	14.70	12.20	9.90	5.87	**12.91**
	Alcohol ext .after Hexane ext.15%	17.90	16.50	13.40	12.30	10.00	6.43	**12.76**
	Alcohol ext. after Hexane ext.20%	18.40	15.90	13.10	11.30	8.50	4.77	**12.00**
	Water ext. after Alcohol ext.10%	17.10	15.20	12.70	10.60	7.60	4.62	**11.30**
	Water ext. after Alcohol ext.15%	16.80	15.40	12.60	10.50	7.30	4.82	**11.24**
	Water ext. after Alcohol ext.20%	16.00	15.00	12.30	10.70	7.90	4.29	**11.03**
Onion	Hexane ext.10%	18.90	16.30	14.80	12.10	9.40	7.23	**13.12**
	Hexane ext.15%	19.10	16.90	14.90	13.40	10.40	7.58	**13.71**
	Hexane ext.20%	19.70	17.90	15.20	13.70	10.60	7.78	**14.15**
	Alcohol ext. after Hexane ext.10%	17.80	15.30	14.40	10.80	7.40	4.73	**11.74**
	Alcohol ext. after Hexane ext.15%	17.50	15.90	13.00	10.50	8.70	5.20	**11.80**
	Alcohol ext. after Hexane ext.20%	18.70	16.10	13.10	10.30	7.90	4.91	**11.84**
	Water ext. after Alcohol ext.10%	16.00	12.20	10.70	9.40	6.10	4.59	**9.83**
	Water ext. after Alcohol ext.15%	16.70	14.40	11.70	9.10	6.00	4.65	**10.43**
	Water ext. after Alcohol ext.20%	16.40	14.10	11.60	9.80	6.60	4.38	**10.48**
	Mean (B)	**17.88**	**15.84**	**13.41**	**11.34**	**8.56**	**5.66**	
LSD value at % level for		**A=0.54**		**B=0.30**		**A*B=1.32**		

Table (6): Effect of garlic and onion different extracts on Firmness (%) of pear fruits stored at 0°C in the second season (2017)

Treatments (A)		Second season 2017						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	14.76	14.39	11.03	7.88	4.91	3.67	**9.44**
Garlic	Hexane ext. 10%	18.55	17.61	15.63	12.82	8.78	7.41	**13.47**
	Hexane ext. 15%	20.12	18.62	16.07	14.00	9.39	7.63	**14.31**
	Hexane ext. 20%	20.87	18.75	16.68	14.93	9.96	7.92	**14.85**
	Alcohol ext. after Hexane ext. 10%	18.98	16.71	15.85	12.92	8.68	6.06	**13.20**
	Alcohol ext .after Hexane ext.15%	17.80	17.12	14.36	12.89	7.70	6.57	**12.74**
	Alcohol ext. after Hexane ext.20%	18.04	15.63	12.99	11.61	7.03	5.07	**11.73**
	Water ext. after Alcohol ext.10%	16.94	16.03	8.94	9.91	6.16	4.02	**10.33**
	Water ext. after Alcohol ext.15%	17.18	15.62	12.87	11.14	5.81	4.20	**11.14**
	Water ext. after Alcohol ext.20%	16.32	14.87	8.81	11.36	5.78	4.63	**10.30**
Onion	Hexane ext.10%	18.53	15.72	14.38	11.77	6.79	7.30	**12.42**
	Hexane ext.15%	19.34	17.33	15.50	13.08	8.40	7.62	**13.55**
	Hexane ext.20%	20.10	18.05	15.74	14.13	8.55	7.80	**14.06**
	Alcohol ext. after Hexane ext.10%	17.32	15.91	15.19	10.91	5.76	5.03	**11.69**
	Alcohol ext. after Hexane ext.15%	17.94	16.15	12.49	11.29	7.18	5.46	**11.75**
	Alcohol ext. after Hexane ext.20%	19.20	16.97	13.82	9.82	6.07	5.19	**11.85**
	Water ext. after Alcohol ext.10%	15.44	11.93	9.94	9.90	4.62	5.21	**9.51**
	Water ext. after Alcohol ext.15%	16.95	14.63	12.65	8.87	4.84	5.34	**10.55**
	Water ext. after Alcohol ext.20%	16.02	13.43	11.86	10.29	4.76	4.71	**10.18**
	Mean (B)	**17.92**	**16.08**	**13.41**	**11.55**	**6.90**	**5.83**	
LSD value at % level for		**A=0.81**		**B=0.45**		**A*B=1.98**		

Total phenols content:

As shown in **Tables (7 and 8)** a gradual significant increase in fruit content of total phenols was observed up to the end of cold storage period. Control fruits exhibited the least significant fruit content of total phenols, while fruits resulting from foliar spraying with Hexane extract of garlic cloves at the highest concentration (20%) induced significantly the highest fruit content of total phenols followed by foliar spraying with Hexane extract of onion bulbs at the highest concentration (20%) after 75 days of cold storage in both seasons.

Plant phenols and flavonoids have several healthy-beneficial roles due to their antioxidant, anticancer, antimicrobial, antiviral and anti-inflammatory properties.One of the main roles of Polyphenols are to reduce the level of Reactive Oxygen Species (ROS) produce in the

plant due to stress such as storage diseases(**Yu *et al.*, (2015); Hyun *et al.*, (2016)** and**Devasagayam *et al.*, (2004))**.

Table (7): Effect of garlic and onion different extracts on total phenol of pear fruits stored at 0°C in the first season (2016)

Treatments (A)		First season 2016						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	0.107	0.137	0.180	0.227	0.282	0.330	**0.211**
Garlic	Hexane ext. 10%	0.223	0.233	0.281	0.409	0.535	0.711	**0.399**
	Hexane ext. 15%	0.241	0.235	0.285	0.415	0.537	0.725	**0.406**
	Hexane ext. 20%	0.267	0.273	0.319	0.467	0.566	0.759	**0.442**
	Alcohol ext. after Hexane ext. 10%	0.137	0.217	0.233	0.330	0.424	0.633	**0.329**
	Alcohol ext .after Hexane ext.15%	0.143	0.222	0.268	0.322	0.421	0.635	**0.335**
	Alcohol ext. after Hexane ext.20%	0.160	0.224	0.271	0.319	0.406	0.636	**0.336**
	Water ext. after Alcohol ext.10%	0.118	0.168	0.224	0.322	0.410	0.534	**0.296**
	Water ext. after Alcohol ext.15%	0.102	0.167	0.227	0.326	0.401	0.547	**0.295**
	Water ext. after Alcohol ext.20%	0.103	0.141	0.233	0.324	0.413	0.533	**0.291**
Onion	Hexane ext.10%	0.165	0.191	0.330	0.515	0.623	0.714	**0.423**
	Hexane ext.15%	0.192	0.211	0.329	0.539	0.629	0.723	**0.437**
	Hexane ext.20%	0.198	0.219	0.332	0.538	0.631	0.725	**0.441**
	Alcohol ext. after Hexane ext.10%	0.121	0.176	0.326	0.406	0.536	0.636	**0.367**
	Alcohol ext. after Hexane ext.15%	0.132	0.179	0.324	0.404	0.533	0.619	**0.365**
	Alcohol ext. after Hexane ext.20%	0.102	0.181	0.328	0.409	0.533	0.629	**0.364**
	Water ext. after Alcohol ext.10%	0.122	0.186	0.228	0.255	0.324	0.426	**0.257**
	Water ext. after Alcohol ext.15%	0.086	0.186	0.222	0.257	0.326	0.419	**0.249**
	Water ext. after Alcohol ext.20%	0.073	0.195	0.227	0.260	0.331	0.417	**0.251**
	Mean (B)	**0.147**	**0.197**	**0.272**	**0.371**	**0.466**	**0.597**	
LSD value at % level for			**A=0.003**		**B=0.002**		**A*B=0.007**	

Table (8): Effect of garlic and onion different extracts on total phenol of pear fruits stored at 0°C in the second season (2017)

Treatments (A)		Second season 2017						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	0.137	0.165	0.205	0.248	0.299	0.344	**0.233**
Garlic	Hexane ext. 10%	0.217	0.254	0.298	0.423	0.535	0.698	**0.404**
	Hexane ext. 15%	0.224	0.256	0.302	0.425	0.536	0.707	**0.408**
	Hexane ext. 20%	0.279	0.283	0.351	0.457	0.569	0.754	**0.449**
	Alcohol ext. after Hexane ext. 10%	0.164	0.239	0.254	0.345	0.432	0.626	**0.343**
	Alcohol ext .after Hexane ext.15%	0.170	0.244	0.287	0.337	0.429	0.627	**0.349**
	Alcohol ext. after Hexane ext.20%	0.186	0.246	0.289	0.334	0.414	0.628	**0.350**
	Water ext. after Alcohol ext.10%	0.147	0.193	0.448	0.337	0.419	0.534	**0.346**
	Water ext. after Alcohol ext.15%	0.132	0.192	0.248	0.341	0.411	0.546	**0.312**
	Water ext. after Alcohol ext.20%	0.133	0.169	0.456	0.339	0.422	0.533	**0.342**
Onion	Hexane ext.10%	0.191	0.215	0.337	0.527	0.617	0.701	**0.431**
	Hexane ext.15%	0.197	0.243	0.343	0.538	0.623	0.709	**0.442**
	Hexane ext.20%	0.201	0.252	0.344	0.537	0.624	0.711	**0.445**
	Alcohol ext. after Hexane ext.10%	0.150	0.201	0.341	0.414	0.536	0.629	**0.379**
	Alcohol ext. after Hexane ext.15%	0.160	0.203	0.339	0.413	0.533	0.613	**0.377**
	Alcohol ext. after Hexane ext.20%	0.132	0.206	0.342	0.418	0.533	0.622	**0.376**
	Water ext. after Alcohol ext.10%	0.151	0.210	0.249	0.274	0.339	0.434	**0.276**
	Water ext. after Alcohol ext.15%	0.117	0.210	0.244	0.276	0.341	0.427	**0.269**
	Water ext. after Alcohol ext.20%	0.105	0.218	0.248	0.279	0.345	0.425	**0.270**
	Mean (B)	**0.168**	**0.221**	**0.312**	**0.382**	**0.471**	**0.593**	
LSD value at % level for		**A=0.005**		**B=0.003**		**A*B=0.012**		

Pectin:

The effect of using garlic and onion extracts on pectin% of pear fruits under storage conditions are presented in **Tables (9 and 10)**. Data showed that total soluble pectin increased gradually till the end of storage period of pear fruits in both seasons. Highest significant fruit content of total soluble pectin was attained with control after 75 days of cold storage, while pear fruits resulting from foliar spraying with Hexane extract for onion or garlic extracts at (20%) of each were the lowest significant fruit content of total soluble pectin in both seasons after 75 days.The obtained results are similar to those achieved by **Sanwal and Payasi (2007)** on banana fruit who found that treated fruits with 1% garlic clove extract or 10% onion bulb extract dealing the fruit softening by diminishing the rate of starch and pectin degradation the rate of increase in softness. Also, **Mahmoud**

(2016) in apple fruits reported that pectin increased gradually from zero time till the end of storage period

Table (9): Effect of garlic and onion different extracts on Pectin (%) of pear fruits stored at 0°C during in the first season (2016)

Treatments (A)		First season 2016						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	0.231	0.336	0.402	0.530	0.620	0.735	**0.476**
Garlic	Hexane ext. 10%	0.139	0.199	0.223	0.299	0.343	0.438	**0.274**
	Hexane ext. 15%	0.121	0.197	0.219	0.298	0.340	0.436	**0.269**
	Hexane ext. 20%	0.119	0.195	0.214	0.292	0.338	0.421	**0.263**
	Alcohol ext. after Hexane ext. 10%	0.190	0.208	0.230	0.309	0.418	0.539	**0.316**
	Alcohol ext .after Hexane ext.15%	0.187	0.210	0.271	0.325	0.461	0.538	**0.332**
	Alcohol ext. after Hexane ext.20%	0.177	0.212	0.282	0.352	0.466	0.545	**0.339**
	Water ext. after Alcohol ext.10%	0.216	0.268	0.320	0.422	0.534	0.642	**0.400**
	Water ext. after Alcohol ext.15%	0.227	0.278	0.314	0.447	0.549	0.646	**0.410**
	Water ext. after Alcohol ext.20%	0.224	0.276	0.345	0.438	0.535	0.626	**0.407**
Onion	Hexane ext.10%	0.148	0.194	0.290	0.298	0.336	0.436	**0.284**
	Hexane ext.15%	0.136	0.191	0.285	0.296	0.316	0.433	**0.276**
	Hexane ext.20%	0.123	0.187	0.272	0.287	0.311	0.430	**0.268**
	Alcohol ext. after Hexane ext.10%	0.166	0.209	0.272	0.343	0.435	0.549	**0.329**
	Alcohol ext. after Hexane ext.15%	0.182	0.215	0.295	0.329	0.434	0.539	**0.332**
	Alcohol ext. after Hexane ext.20%	0.170	0.216	0.298	0.417	0.414	0.537	**0.342**
	Water ext. after Alcohol ext.10%	0.206	0.213	0.340	0.433	0.540	0.632	**0.394**
	Water ext. after Alcohol ext.15%	0.217	0.220	0.335	0.446	0.533	0.634	**0.398**
	Water ext. after Alcohol ext.20%	0.222	0.258	0.345	0.422	0.534	0.625	**0.401**
	Mean (B)	**0.179**	**0.225**	**0.292**	**0.368**	**0.445**	**0.546**	
LSD value at % level for		**A=0.006**		**B=0.003**		**A*B=0.015**		

Table (10): Effect of garlic and onion different extracts on Pectin (%) of pear fruits stored at 0°Cduring in the second season (2017)

Treatments (A)		Second season 2017						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	0.245	0.343	0.405	0.525	0.610	0.717	**0.474**
Garlic	Hexane ext. 10%	0.158	0.215	0.295	0.308	0.347	0.437	**0.293**
	Hexane ext. 15%	0.148	0.211	0.247	0.302	0.345	0.432	**0.281**
	Hexane ext. 20%	0.142	0.204	0.229	0.297	0.322	0.421	**0.269**
	Alcohol ext. after Hexane ext. 10%	0.206	0.223	0.275	0.318	0.420	0.533	**0.329**
	Alcohol ext .after Hexane ext.15%	0.194	0.227	0.292	0.358	0.465	0.539	**0.346**
	Alcohol ext. after Hexane ext.20%	0.188	0.230	0.308	0.419	0.417	0.532	**0.349**
	Water ext. after Alcohol ext.10%	0.241	0.289	0.322	0.447	0.543	0.633	**0.413**
	Water ext. after Alcohol ext.15%	0.238	0.287	0.352	0.439	0.530	0.615	**0.410**
	Water ext. after Alcohol ext.20%	0.232	0.234	0.342	0.447	0.527	0.622	**0.401**
Onion	Hexane ext.10%	0.167	0.213	0.428	0.308	0.352	0.438	**0.318**
	Hexane ext.15%	0.156	0.207	0.337	0.306	0.347	0.437	**0.298**
	Hexane ext.20%	0.133	0.192	0.283	0.291	0.329	0.424	**0.275**
	Alcohol ext. after Hexane ext.10%	0.204	0.225	0.282	0.333	0.452	0.531	**0.338**
	Alcohol ext. after Hexane ext.15%	0.199	0.230	0.304	0.336	0.435	0.534	**0.340**
	Alcohol ext. after Hexane ext.20%	0.184	0.224	0.435	0.349	0.436	0.543	**0.362**
	Water ext. after Alcohol ext.10%	0.221	0.228	0.347	0.434	0.534	0.620	**0.397**
	Water ext. after Alcohol ext.15%	0.236	0.233	0.352	0.424	0.528	0.614	**0.398**
	Water ext. after Alcohol ext.20%	0.231	0.279	0.328	0.424	0.528	0.630	**0.403**
	Mean (B)	**0.196**	**0.237**	**0.324**	**0.372**	**0.446**	**0.540**	
LSD value at % level for		**A=0.008**		**B=0.004**		**A*B=0.020**		

Generally, spraying with garlic or onion ethanolic or aqueous extracts decreased pectin content of the fruits as compared to untreated trees.

During ripening, parenchyma cell walls are extensively modified, altering their mechanical properties, and cell adhesion are significantly reduced as a result of middle lamella dissolution. Cell wall and middlelamella modifications leading to fruit softening result from the action of cell wall modifying enzymes (e.g. polygalacturonase, pectin methylesterase, pectatelyase, b-galactosidase, cellulase),generally encoded by ripening-related genes **(Brummell and Harpster, 2001; Goulao and Oliveira, 2008)**. Other cell wall proteins, with no hydrolytic enzyme activity, such as expansins, also have a role in softening **(Brummell *et al.*, 1999)**. In general, the cell wall disassembly process responsible for softening involves the depolymerization of matrixglycans, the solubilization and depolymerization of pectins and the loss of neutral sugars from pectin side chains **(Brummell, 2006** and**Goulao and Oliveira, 2008)**.

Pectinase:

Results presented in **Tables (11 and 12)** revealed the effect of using onion or garlic extracts on pectinase activity of pear fruits under storage conditions. Results showed that the pectinase enzyme activity increases by extending storage period at zero temperature of pear fruits. All treatments with garlic and onion extracts decrease the pectinase enzyme activity compared with control in second season. The lowest pectinase enzyme activity was recorded by the spraying of the pear with hexane extract of garlic at 20%. Fruits resulting from foliar spraying with Hexane extract of garlic cloves at the highest concentration (20%) induced significantly the least fruit content of pectinase activity followed by foliar spraying with Hexane extract of onion bulbs at the highest concentration (20%) after 75 days of cold storage in both seasons.Probably, pectins are the cell wall components that change most during fruit softening, but their role in fruit firmness and softening is considered controversial**(Brummell and Harpster, 2001)**.Pectinases are a big group of enzymes that break down pectic polysaccharides of plant tissues into simpler molecules like galacturonic acids (**Pedrolli *et al.*, 2009)**.

Table (11): Effect of garlic and onion different extracts on Pectinase activity(%) of pear fruits stored at 0°C in the first season (2016)

Treatments (A)		First season 2016						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	0.400	0.440	0.520	0.730	0.910	1.360	**0.727**
Garlic	Hexane ext. 10%	0.180	0.250	0.380	0.580	0.780	0.920	**0.515**
	Hexane ext. 15%	0.160	0.240	0.350	0.570	0.760	0.910	**0.498**
	Hexane ext. 20%	0.140	0.210	0.330	0.560	0.740	0.860	**0.473**
	Alcohol ext. after Hexane ext. 10%	0.180	0.230	0.560	0.630	0.940	1.250	**0.632**
	Alcohol ext .after Hexane ext.15%	0190	0.270	0.590	0.680	0.920	1.430	**0.680**
	Alcohol ext. after Hexane ext.20%	0.220	0.250	0.540	0.670	0.910	1.360	**0.658**
	Water ext. after Alcohol ext.10%	0.260	0.310	0.510	0.730	0.920	1.320	**0.675**
	Water ext. after Alcohol ext.15%	0.280	0.350	0.540	0.750	0.940	1.290	**0.692**
	Water ext. after Alcohol ext.20%	0.270	0.340	0.570	0.710	0.980	1.260	**0.688**
Onion	Hexane ext.10%	0.140	0.270	0.390	0.590	0.790	0.990	**0.528**
	Hexane ext.15%	0.110	0.230	0.360	0.550	0.750	0.980	**0.497**
	Hexane ext.20%	0.100	0.210	0.350	0.540	0.740	0.970	**0.485**
	Alcohol ext. after Hexane ext.10%	0.240	0.290	0.410	0.710	0.980	1.170	**0.633**
	Alcohol ext. after Hexane ext.15%	0.230	0.270	0.450	0.750	0.950	1.090	**0.623**
	Alcohol ext. after Hexane ext.20%	0.210	0.280	0.470	0.730	0.960	1.250	**0.650**
	Water ext. after Alcohol ext.10%	0.310	0.390	0.460	0.650	0.840	1.260	**0.652**
	Water ext. after Alcohol ext.15%	0.290	0.380	0.480	0.670	0.870	1.220	**0.652**
	Water ext. after Alcohol ext.20%	0.340	0.380	0.490	0.680	0.890	1.250	**0.672**
	Mean (B)	**0.224**	**0.294**	**0.461**	**0.657**	**0.872**	**1.165**	
LSD value at % level for		**A=0.013**		**B=0.007**		**A*B=0.032**		

Table (12): Effect of garlic and onion different extracts on Pectinase activity (%) of pear fruits stored at 0°C in the second season (2017)

Treatments (A)		Second season 2017						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	0.419	0.454	0.526	0.724	0.896	1.307	**0.721**
Garlic	Hexane ext. 10%	0.210	0.279	0.359	0.582	0.770	0.913	**0.525**
	Hexane ext. 15%	0.192	0.271	0.375	0.578	0.749	0.903	**0.511**
	Hexane ext. 20%	0.174	0.234	0.353	0.564	0.738	0.892	**0.493**
	Alcohol ext. after Hexane ext. 10%	0.214	0.257	0.566	0.632	0.925	1.207	**0.634**
	Alcohol ext .after Hexane ext.15%	0.220	0.294	0.596	0.675	0.902	1.376	**0.677**
	Alcohol ext. after Hexane ext.20%	0.247	0.275	0.553	0.667	0.890	1.311	**0.657**
	Water ext. after Alcohol ext.10%	0.284	0.338	0.811	0.723	0.901	1.270	**0.721**
	Water ext. after Alcohol ext.15%	0.304	0.372	0.522	0.741	0.924	1.247	**0.690**
	Water ext. after Alcohol ext.20%	0.298	0.364	0.822	0.706	0.955	1.223	**0.728**
Onion	Hexane ext.10%	0.176	0.300	0.409	0.596	0.777	0.985	**0.541**
	Hexane ext.15%	0.145	0.260	0.377	0.554	0.746	0.960	**0.507**
	Hexane ext.20%	0.140	0.237	0.373	0.551	0.735	0.952	**0.498**
	Alcohol ext. after Hexane ext.10%	0.720	0.312	0.432	0.706	0.958	1.138	**0.711**
	Alcohol ext. after Hexane ext.15%	0.263	0.302	0.464	0.743	0.927	1.061	**0.627**
	Alcohol ext. after Hexane ext.20%	0.243	0.303	0.485	0.725	0.940	1.210	**0.651**
	Water ext. after Alcohol ext.10%	0.340	0.407	0.473	0.649	0.826	1.223	**0.653**
	Water ext. after Alcohol ext.15%	0.314	0.397	0.490	0.669	0.852	1.185	**0.651**
	Water ext. after Alcohol ext.20%	0.360	0.403	0.500	0.677	0.875	1.214	**0.672**
	Mean (B)	**0.277**	**0.319**	**0.503**	**0.656**	**0.857**	**1.136**	
LSD value at % level for		**A=0.011**		**B=0.006**		**A*B=0.027**		

Peroxidase:

As shown in **Tables (13 and 14)**, a gradual significant increase in fruit content of peroxidase enzyme activity was observed up to the end of cold storage period. Control fruits exhibited the highest significant fruit content of peroxidase enzyme activity, while fruits resulting from foliar spraying with hexane extract of garlic cloves at the highest concentration (20%) induced significantly the least fruit content of peroxidase enzyme activity followed by foliar spraying with hexane extract of onion bulbs at the highest concentration (20%) after 75 days of cold storage in both seasons.

Table (13): Effect of garlic and onion different extracts on Peroxidase activity (%) of pear fruits stored at 0°C in the first season (2016)

Treatments (A)		first season 2016						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	0.390	0.500	0.580	0.680	0.990	1.290	**0.738**
Garlic	Hexane ext. 10%	0.220	0.270	0.350	0.400	0.710	0.960	**0.485**
	Hexane ext. 15%	0.210	0.240	0.320	0.390	0.690	0.940	**0.465**
	Hexane ext. 20%	0.190	0.240	0.310	0.380	0.680	0.920	**0.453**
	Alcohol ext. after Hexane ext. 10%	0.300	0.340	0.400	0.410	0.790	1.010	**0.542**
	Alcohol ext .after Hexane ext.15%	0.270	0.320	0.410	0.460	0.790	1.020	**0.545**
	Alcohol ext. after Hexane ext.20%	0.290	0.350	0.380	0.410	0.780	1.010	**0.537**
	Water ext. after Alcohol ext.10%	0.340	0.410	0.510	0.610	0.980	1.330	**0.697**
	Water ext. after Alcohol ext.15%	0.340	0.430	0.500	0.610	0.990	1.220	**0.682**
	Water ext. after Alcohol ext.20%	0.350	0.390	0.500	0.620	1.010	1.230	**0.683**
Onion	Hexane ext.10%	0.250	0.310	0.340	0.400	0.710	1.010	**0.503**
	Hexane ext.15%	0.250	0.290	0.330	0.390	0.670	0.990	**0.487**
	Hexane ext.20%	0.230	0.270	0.320	0.380	0.660	0.940	**0.467**
	Alcohol ext. after Hexane ext.10%	0.320	0.350	0.390	0.450	0.720	1.080	**0.552**
	Alcohol ext. after Hexane ext.15%	0.320	0.360	0.390	0.470	0.740	1.070	**0.558**
	Alcohol ext. after Hexane ext.20%	0.300	0.330	0.380	0.430	0.770	1.050	**0.543**
	Water ext. after Alcohol ext.10%	0.390	0.410	0.440	0.570	0.960	1.280	**0.675**
	Water ext. after Alcohol ext.15%	0.370	0.420	0.480	0.580	0.960	1.270	**0.680**
	Water ext. after Alcohol ext.20%	0.390	0.430	0.480	0.590	0.960	1.260	**0.685**
	Mean (B)	**0.301**	**0.351**	**0.411**	**0.486**	**0.819**	**1.099**	
LSD value at % level for		**A=0.014**		**B=0.008**		**A*B=0.034**		

Table (14): Effect of garlic and onion different extracts on Peroxidase activity (%) of pear fruits stored at 0°C in the second season (2017)

Treatments (A)		Second season 2017						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	0.566	0.667	0.740	0.843	1.138	1.421	**0.896**
Garlic	Hexane ext. 10%	0.376	0.439	0.517	0.571	0.847	1.102	**0.642**
	Hexane ext. 15%	0.374	0.422	0.493	0.560	0.846	1.090	**0.631**
	Hexane ext. 20%	0.374	0.418	0.483	0.552	0.843	1.070	**0.623**
	Alcohol ext. after Hexane ext. 10%	0.478	0.481	0.572	0.586	0.942	1.150	**0.702**
	Alcohol ext .after Hexane ext.15%	0.449	0.491	0.586	0.632	0.940	1.158	**0.709**
	Alcohol ext. after Hexane ext.20%	0.469	0.526	0.555	0.584	0.940	1.156	**0.705**
	Water ext. after Alcohol ext.10%	0.516	0.576	0.891	0.771	1.127	1.459	**0.890**
	Water ext. after Alcohol ext.15%	0.516	0.603	0.664	0.722	1.131	1.351	**0.840**
	Water ext. after Alcohol ext.20%	0.526	0.558	0.900	0.777	1.156	1.364	**0.880**
Onion	Hexane ext.10%	0.429	0.490	0.523	0.573	0.858	1.142	**0.669**
	Hexane ext.15%	0.424	0.462	0.518	0.566	0.826	1.136	**0.655**
	Hexane ext.20%	0.414	0.452	0.497	0.565	0.823	1.082	**0.639**
	Alcohol ext. after Hexane ext.10%	0.500	0.528	0.565	0.622	0.873	1.221	**0.718**
	Alcohol ext. after Hexane ext.15%	0.491	0.531	0.566	0.637	0.895	1.214	**0.722**
	Alcohol ext. after Hexane ext.20%	0.479	0.506	0.549	0.603	0.919	1.192	**0.708**
	Water ext. after Alcohol ext.10%	0.557	0.500	0.611	0.737	1.107	1.407	**0.820**
	Water ext. after Alcohol ext.15%	0.548	0.595	0.651	0.741	1.102	1.398	**0.839**
	Water ext. after Alcohol ext.20%	0.565	0.604	0.652	0.747	1.107	1.394	**0.845**
	Mean (B)	**0.277**	**0.319**	**0.503**	**0.656**	**0.857**	**1.136**	
LSD value at % level for		**A=0.017**		**B=0.009**		**A*B=0.042**		

Polyphenoloxidase:

Data in **Tables (15 and 16)** found that fruit content of polyphenol oxidase enzyme activity increased gradually till the end of the cold storage period of pear fruits in both seasons. It can be observed that fruit content of polyphenol oxidase enzyme activity was decreased by foliar spraying with hexane extract of garlic or onion plants as compared to other extracts and control. Highest significant fruit content of polyphenol oxidase enzyme activity was attained with control after 75 days of cold storage, while pear fruits resulting from foliar spraying with hexane extract for each of the onion or garlic plants at the highest concentration of each (20%) resulted in significantly the least fruit content of polyphenol oxidase enzyme activity at the end of the cold storage in both seasons.These results are in line with those obtained by **Mahmoud (2016)** on apple fruits using aqueous and ethanolic extracts of garlic and onion. She illustrated that

the activity of peroxidase and polyphenol oxidase enzymes increased gradually from zero time till four weeks of storage.

Table (15): Effect of garlic and onion different extracts on Polyphenol oxidase activity (%) of pear fruits stored at 0°C during in the first season (2016)

Treatments (A)		First season 2016						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	0.160	0.300	0.650	1.320	1.720	2.300	1.075
Garlic	Hexane ext. 10%	0.030	0.070	0.180	0.470	0.680	1.020	0.408
	Hexane ext. 15%	0.030	0.050	0.180	0.450	0.670	1.010	0.398
	Hexane ext. 20%	0.040	0.050	0.160	0.420	0.650	0.910	0.372
	Alcohol ext. after Hexane ext. 10%	0.070	0.080	0.190	0.510	0.660	1.540	0.508
	Alcohol ext .after Hexane ext.15%	0.070	0.080	0.200	0.510	0.670	1.560	0.515
	Alcohol ext. after Hexane ext.20%	0.070	0.090	0.200	0.520	0.690	1.590	0.527
	Water ext. after Alcohol ext.10%	0.130	0.160	0.320	0.780	0.900	1.850	0.690
	Water ext. after Alcohol ext.15%	0.150	0.170	0.330	0.780	0.920	1.860	0.702
	Water ext. after Alcohol ext.20%	0.150	0.170	0.330	0.790	0.930	1.860	0.705
Onion	Hexane ext.10%	0.050	0.080	0.170	0.520	0.710	1.370	0.483
	Hexane ext.15%	0.040	0.070	0.160	0.510	0.690	1.340	0.468
	Hexane ext.20%	0.030	0.070	0.160	0.490	0.680	1.320	0.458
	Alcohol ext. after Hexane ext.10%	0.080	0.180	0.330	0.750	0.840	1.660	0.640
	Alcohol ext. after Hexane ext.15%	0.080	0.150	0.310	0.740	0.830	1.730	0.640
	Alcohol ext. after Hexane ext.20%	0.070	0.140	0.310	0.730	0.800	1.800	0.642
	Water ext. after Alcohol ext.10%	0.160	0.210	0.520	0.940	1.480	1.980	0.882
	Water ext. after Alcohol ext.15%	0.180	0.200	0.530	0.920	1.350	1.960	0.857
	Water ext. after Alcohol ext.20%	0.160	0.220	0.510	0.900	1.150	1.940	0.813
	Mean (B)	**0.092**	**0.134**	**0.302**	**0.687**	**0.896**	**1.611**	
LSD value at % level for		**A=0.089**		**B=0.053**		**A*B=0.222**		

Table (16): Effect of garlic and onion different extracts on Polyphenol oxidase activity (%) of pear fruits stored at 0°C during in the second season (2017)

Treatments (A)		Second season 2017						
		Storage period by days (B)						
		0	15	30	45	60	75	Mean (A)
	Control	0.275	0.368	0.697	1.324	1.689	2.236	**1.098**
Garlic	Hexane ext. 10%	0.073	0.154	0.259	0.532	0.725	1.046	**0.465**
	Hexane ext. 15%	0.069	0.144	0.249	0.507	0.717	1.028	**0.452**
	Hexane ext. 20%	0.061	0.156	0.237	0.486	0.691	0.938	**0.428**
	Alcohol ext. after Hexane ext. 10%	0.101	0.18	0.273	0.571	0.711	1.528	**0.561**
	Alcohol ext .after Hexane ext.15%	0.098	0.179	0.281	0.571	0.718	1.547	**0.566**
	Alcohol ext. after Hexane ext.20%	0.101	0.191	0.281	0.581	0.736	1.572	**0.577**
	Water ext. after Alcohol ext.10%	0.162	0.244	0.968	0.82	0.932	1.818	**0.824**
	Water ext. after Alcohol ext.15%	0.181	0.247	0.402	0.82	0.951	1.825	**0.738**
	Water ext. after Alcohol ext.20%	0.176	0.253	0.991	0.831	0.963	1.825	**0.840**
Onion	Hexane ext.10%	0.077	0.185	0.273	0.542	0.738	1.389	**0.534**
	Hexane ext.15%	0.065	0.171	0.265	0.531	0.737	1.343	**0.519**
	Hexane ext.20%	0.062	0.165	0.253	0.527	0.734	1.323	**0.511**
	Alcohol ext. after Hexane ext.10%	0.113	0.257	0.395	0.792	0.87	1.64	**0.678**
	Alcohol ext. after Hexane ext.15%	0.107	0.232	0.386	0.783	0.868	1.706	**0.680**
	Alcohol ext. after Hexane ext.20%	0.115	0.225	0.377	0.768	0.841	1.768	**0.682**
	Water ext. after Alcohol ext.10%	0.189	0.29	0.581	0.963	1.472	1.931	**0.904**
	Water ext. after Alcohol ext.15%	0.202	0.281	0.583	0.945	1.345	1.918	**0.879**
	Water ext. after Alcohol ext.20%	0.246	0.301	0.569	0.932	1.162	1.9	**0.852**
	Mean (B)	**0.130**	**0.222**	**0.438**	**0.728**	**0.926**	**1.594**	
LSD value at % level for		**A=0.087**		**B=0.048**			**A*B=0.213**	

Postharvest oxidative stress occurs during fruit storage, causing an imbalance between the production and removal of reactive oxygen species (ROS), such as H_2O_2, O_2^- and hydroxyl radicals, from the tissues. The protection of fruit cells from oxidative injury depends on the level of antioxidant enzymes, such as catalase, peroxidase, polyphenol oxidase and superoxide dismutase which scavenge ROS and prevent harmful effects**(Mittler, 2002** and**Zeng *et al.*, 2010)** and these enzymes are commonly found in nearly all organisms exposed to oxygen **(Chelikani *et al.*, 2004)**.

Polyphenol oxidase and peroxidase catalyze the reactions involved in enzymatic browning, the most important color reaction affecting fruits and vegetables.

The beneficial effects of garlic extract on fruiting might be attributed to its higher content of many antioxidants such as

organosulfur compounds; S-allylcysteine, allinin, diallydisulfide, diallylsulfideajoene and allicin. Antioxidant action was determined by their ability to scavenge reactive oxygen species and inhibit the formation of lipid peroxidation (**Borek,2001; Amagase, 2006** and**Yokoya and Handro,1997)**. Excess of H_2O_2 could inhibit or alter auxin catabolism, ethylene biosynthesis and cell wall lignification; thus affecting peroxidase activity which is involved in different aspects related to growth **(Yokoya and Handro, 1997).** This affects reducing postharvest oxidative stress through the enhancement of antioxidant enzyme activities that reduce oxidative damage via the regulation of ROS metabolism and delayed fruit browning through the inhibition of polyphenol oxidase and peroxidase (**Petriccione *et al.*,2015)**.

Conclusions:

The studies recommend spraying hexane extract of garlic or onion as natural products to extend keeping quality of pear fruits.

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تأثير مستخلصات الثوم والبصل كمعاملات ما قبل الحصاد على صفات الجوده ونشاط إنزيمات الأكسدة أثناء التخزين المبرد لثمار الكمثري

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هناك حاجة مستمرة للبحث عن مصادر طبيعية بديلة وآمنة من مصادر نباتيه كمعاملات ما قبل الحصاد. حيث أن استخدام المركبات الكيميائية تكون شديدة التلوث وخطيرة واكثر تكلفه. والنباتات الطبية لها دور في تثبيط تفاعلات الأكسدة الخلوية ومسببات الأمراض التي تصيب النباتات. وهنا تبرز أهمية إيجاد مصادر نباتيه كمغذيات ومضادة للميكروبات. الكمثرى هي واحد من الفواكه المفضلة في المنطقة المناخية المعتدلة. أجريت الدراسة خلال موسمين على أشجار الكمثرى صنف ليكونت عمر 8 سنوات (*Pyruscommunis*) المطعومه على (*Pyrusbetulaefolia*) . كانت عدد المعاملات تسعة عشر معاملة بما في ذلك الكنترول ، تم الرش في ثلاث مرات لكل معامله بمستخلصات متتابعه من الثوم والبصل(هكسان ، إيثانول ثم الماء) بتركيزات 10 ، 15 و 20 ٪أولاً عند نسبة 50٪ من التزهير، ثم كانت المرة الثانية بعد إكتمال العقد والثالثة بعد شهر واحد من إكتمال العقد. خزنت الثمار تحت ظروف التخزين المبرد. تظهر النتائج أن استخدام 20٪ مستخلصات

الهكسان لكل من الثوم والبصل حسنت صفات الجوده أثناء التخزين عن طريق أعطاء اقل قيم في نسبه التالف والفقدان في وزن الثمرة والبكتين الذائب بالاضافه الي تثبيط نشاط انزيمات البكتينيز ، والبيروكسيديز والبولي فينول أوكسيديزوأعطت أعلي قيم للصلابه والفينولات الكليه مقارنه بالكنترول. ومن النتائج المتحصل عليها نوصي برش مستخلص الهكسان لكل من الثوم أو البصل كمنتجات طبيعية لزيادة جودة ثمار الكمثرى.