

# The effects of different essential fruit juice and their combination on *Saccharomyces cerevisiae* cell growth

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**Summary.** In this study, 15 groups were composed. i: Control group, ii: H<sub>2</sub>O<sub>2</sub> group, iii: Strawberry + H<sub>2</sub>O<sub>2</sub> juice group, iv: Banana juice + H<sub>2</sub>O<sub>2</sub> group and v: Strawberry + Banana juice + H<sub>2</sub>O<sub>2</sub> group. 1: Control group, 2: H<sub>2</sub>O<sub>2</sub> group, 3: Apple + H<sub>2</sub>O<sub>2</sub> juice group, 4: Watermelon juice + H<sub>2</sub>O<sub>2</sub> groups and 5: Apple + Watermelon juice + H<sub>2</sub>O<sub>2</sub> group. A: Control group, B: H<sub>2</sub>O<sub>2</sub> group, C: Cherry + H<sub>2</sub>O<sub>2</sub> juice group, D: Peach juice + H<sub>2</sub>O<sub>2</sub> groups and E: Cherry + Peach juice + H<sub>2</sub>O<sub>2</sub> group. After sterilization, fruit juice (20%) and H<sub>2</sub>O<sub>2</sub> (6% v/v) were inserted to *Saccharomyces cerevisiae* (*S. cerevisiae*) cultures and the cultures were developed at 37°C for 1h, 3h, 5h and 72 hours (overnight). *S. cerevisiae* cell growth was determined by spectrophotometer. With respect to our studies results; cell growth rised in fruit juice groups to which Strawberry, banana, apple, watermelon, cherry, peach was taken in proportion to the positive control (H<sub>2</sub>O<sub>2</sub>) group at different growing times (1, 3, 5 and 72 hours) (p<0,05). As a result different fruit juices and their combination has a protective role for decrease the oxidative damage and increased cell growing in *S. cerevisiae*.

**Key words:** *S. cerevisiae*, apple juice, cherry juice, banana juice, strawberry juice, oxidative damage

«GLI EFFETTI DI DIVERSI SUCCHI DI FRUTTA ESSENZIALI E LORO COMBINAZIONE SULLA CRESCITA CELLULARE DI SACCHAROMYCES CEREVISIAE»

**Riassunto.** In questo studio sono stati allestiti 15 gruppi. i: gruppo di controllo, ii: gruppo H<sub>2</sub>O<sub>2</sub>, iii: gruppo succo di fragola + H<sub>2</sub>O<sub>2</sub>, iv: gruppo succo di banana + H<sub>2</sub>O<sub>2</sub> e v: gruppo succo di fragola + succo di banana + H<sub>2</sub>O<sub>2</sub>. 1: gruppo di controllo, 2: gruppo H<sub>2</sub>O<sub>2</sub>, 3: gruppo succo di mela + H<sub>2</sub>O<sub>2</sub>, 4: gruppo succo di anguria + H<sub>2</sub>O<sub>2</sub> e 5: gruppo succo di mela + succo di anguria + H<sub>2</sub>O<sub>2</sub> group. A: gruppo di controllo, B: gruppo H<sub>2</sub>O<sub>2</sub>, C: gruppo succo di ciliegia + H<sub>2</sub>O<sub>2</sub>, D: gruppo succo di pesca + H<sub>2</sub>O<sub>2</sub> e E: gruppo succo di ciliegia + succo di pesca + H<sub>2</sub>O<sub>2</sub>. Dopo sterilizzazione, il succo di frutta (20%) e l'H<sub>2</sub>O<sub>2</sub> (6% v/v) sono stati aggiunti alle colture di *Saccharomyces cerevisiae* (*S. cerevisiae*) e le colture sono state incubate a 37°C for 1 h, 3 h, 5 h and 72 ore (overnight). La crescita di *S. cerevisiae* è stata determinata utilizzando uno spettrofotometro. Per quanto riguarda i nostri studi sono stati ottenuti i seguenti risultati: la crescita cellulare è aumentata nei gruppi con succo di frutta quale fragola, banana, mela, anguria, ciliegie, pesca in proporzione al gruppo di controllo positivo (H<sub>2</sub>O<sub>2</sub>) ai diversi tempi di crescita (1, 3, 5 e 72 ore) (p <0,05). I diversi succhi di frutta e le loro combinazioni quindi hanno un ruolo protettivo in *S. cerevisiae* con una diminuzione dello stress ossidativo ed un aumento della crescita cellulare.

**Parole chiave:** *S. cerevisiae*, succo di mela, succo di ciliegia, succo di banana, succo di fragola, danno ossidativo

## Introduction

Apple juices have kept the fruit juice market for many years, but in the last decade, new species of fruit juice products, including strawberry, pomegranate, cherry juices, have come into the consumption. Strawberry juice is a healthy compound, including anthocyanins and vitamin C, and so has strongly antioxidant activity. During the recent years, their potential health benefits have been under the spotlight. Their benefits on health are; prohibit cancers and heart diseases by way of their antioxidant capacities (1-4) and tomato powder has protective effect on colorectal cancer in rat (5).

Watermelon is one of the ample and cheap fruits of India. Watermelon manufacturing contains 6–7% of total fruit generation. It is cheap and best food-grade and thus it provides for yeast immobilisation and thus watermelon (*Citrullus vulgaris*) were checked for acceptability as backing for immobilisation of yeast in wine fermentation by *S. cerevisiae* strain (6). *S. cerevisiae* is an important type of yeast that is used in bread making, beer, wine, since ancient times. This is one of the eukaryotic organisms most widely studied on yeast in molecular biology and cell biology (7). The budding yeast *S. cerevisiae* is round or oval shapes. It is easy to culture. Otherwise, since it is an eukaryotic organism which also has the structure of intracellular complex. Cell cycle proteins, such as signaling proteins, many of which are an important protein in humans, before the investigation of the provision was found in yeasts. Chemicals, detergents, free radical harmful substances etc. which has been used in many areas of daily life, taking into account all of the use of the unconscious of people, this situation has been adversely affected our lives. The most important free radicals are superoxide and hydroxyl radicals. Many of free radicals are origin of oxygen. One of these harmful free radicals is hydrogen peroxide (8, 9). In recent years, Strawberry, pomegranate, peach, cherry fruit is consumed as fresh as many antioxidant activity, which has been proven to work done (10, 11). And also these fruit were used a lot of studies for antioxidant source. In this study we investigated the effect of strawberry, peach, pomegranate, cherry, banana juice and crude extracts on *S. cerevisiae* cell growth.

## Material and methods

### *Research groups and growth conditions*

Fifteen groups were composed; i: Control group, ii: H<sub>2</sub>O<sub>2</sub> group, iii: Strawberry + H<sub>2</sub>O<sub>2</sub> juice group, iv: Banana juice + H<sub>2</sub>O<sub>2</sub> group and v: Strawberry + Banana juice + H<sub>2</sub>O<sub>2</sub> group. 1: Control group, 2: H<sub>2</sub>O<sub>2</sub> group, 3: Apple + H<sub>2</sub>O<sub>2</sub> juice group, 4: Watermelon juice + H<sub>2</sub>O<sub>2</sub> groups and 5: Apple + Watermelon juice + H<sub>2</sub>O<sub>2</sub> group. A: Control group, B: H<sub>2</sub>O<sub>2</sub> group, C: Cherry + H<sub>2</sub>O<sub>2</sub> juice group, D: Peach juice + H<sub>2</sub>O<sub>2</sub> groups and E: Cherry + Peach juice + H<sub>2</sub>O<sub>2</sub> group. Occurrence media of *S. cerevisiae*: for the developed and reproduce of yeast, YEPD (for 50 mL 2 g yeast extract, 2 g trypton, 2 g glucose) in addition, for the developed and reproduce of *S. cerevisiae*, fruit juices was added and improved. After sterilization, yeasts were cultured into media and the samples were incubated for 1 h, 3 h, 5 h, 72 h (overnight, h: hour) at 37°C (12, 13).

### *Fruit juice extract and H<sub>2</sub>O<sub>2</sub> Chemical*

Fruit (from center county of Elazığ city) was squashed in water and added in to *S. cerevisiae* media cultures and added 20% (v/v) ratio in at the reproducing for 37°C. H<sub>2</sub>O<sub>2</sub> was inserted in H<sub>2</sub>O<sub>2</sub> and Fruit juices+H<sub>2</sub>O<sub>2</sub> groups for 6% (v/v) ratio.

### *Cell Intensity measurements*

In these measurements, culture samples that were developed at 37°C for 1, 3, 5 hours and overnight (72 hours) have been analyzed. The measurement has been carried out using a spectrophotometer at 600 nm (OD<sub>600</sub>).

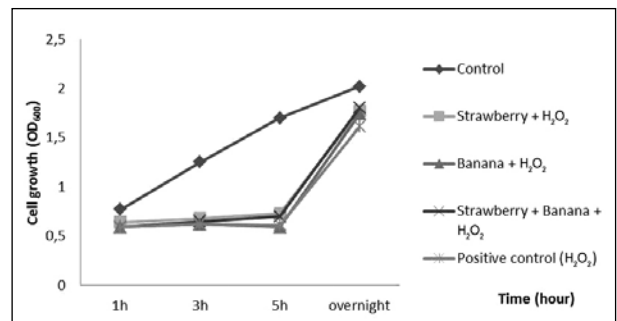
### *Statistical analysis*

For statistical analysis the SPSS 20.0 software was used. The comparison between experimental groups and the control group was made using one way ANOVA and LSD tests. Statistically significant differences among groups have been stated as p<0.05 and the statistically non-significant differences have been stated as p>0.05. Standard deviations were indicated as ±.

## Results and discussion

With respect to in this study results, we hope that meaningful results have been obtained. When looking at these results, common and effective mechanism of different fruit juices and their combination can be tested on different living organisms. For that purpose, we expect that our study has important additive to scientific literature. According to our results, there are some differentiation in membrane structure in  $H_2O_2$  groups in comparison with control group. Odriozola-Serrano et al. (2009) performed a study with similar results (1). Almeida et al (2000) indicated that  $H_2O_2$  induced the lethality of *Escherichia coli* in low iron conditions (14) Santos et al (2012) have point out that in given Pomegranate juice groups in comparison with control group intensity of cell population the survival rate increased (15). According to Yan et al (2011)  $H_2O_2$  has inverse effects on the  $\beta$ -caroten synthesis in yeast which the repressive effect of oxidative damage (16), in another study Serrano et al (2009) and Sun et al (2011) indicated that strawberry, cherry and apple juice has essential antioxidant capacities (17, 18). Segovia-Bravo et al (2012) emphasized that due to strawberry juice yeasts and moulds increased by more than 3 log<sub>10</sub> units (19), Evrendilek et al (2008) point out that in sour cherry juice, peach and apricot nectars the growing of *Penicillium expansum* microorganism was inhibited (20). Guo et al (2013) indicated that apple juice provides to yeast (*S. cerevisiae*) for their capacity to absorb Patulin toxin secondary metabolite (21). According to our data in Table 1, Figure 1: 1h time; in Strawberry +  $H_2O_2$  groups cell growth was increased in comparison with positive control group ( $H_2O_2$ ) ( $p < 0.05$ ) but in Banana +  $H_2O_2$  and Strawberry + Banana +  $H_2O_2$  group cell growth was similar to positive control group ( $H_2O_2$ ) ( $p > 0.05$ ). In 3h

time; cell growth of in all group was similar with positive control group ( $H_2O_2$ ) ( $p > 0.05$ ). In 5h time; in Strawberry +  $H_2O_2$  group cell growth was increased, in Banana +  $H_2O_2$  group cell growth was decreased, in Strawberry + Banana +  $H_2O_2$  group cell growth was increased in comparison with positive control group ( $H_2O_2$ ) ( $p < 0.05$ ). In overnight time; in Strawberry +  $H_2O_2$  group, in Banana +  $H_2O_2$  group, in Strawberry + Banana +  $H_2O_2$  group cell growth was increased in comparison with positive control group ( $H_2O_2$ ) ( $p < 0.05$ ). In Table 2, Figure 2: in 1h, 3h, 5h times; in Apple +  $H_2O_2$  group, in Watermelon +  $H_2O_2$  group, Apple + Watermelon +  $H_2O_2$  group cell growth was increased in comparison with positive control group ( $H_2O_2$ ) ( $p < 0.05$ ). In overnight time; while cell growth was very increased in comparison with positive control group ( $H_2O_2$ ) ( $p < 0.05$ ), in Apple +  $H_2O_2$  group, in Watermelon +  $H_2O_2$  cell growth was similar to positive control group ( $H_2O_2$ ) ( $p > 0.05$ ). In Table 3, Figure 3: in 1h time; in Cherry + Peach +  $H_2O_2$  group cell growth was very increased, in Cherry +  $H_2O_2$  group, in Peach +  $H_2O_2$  group cell growth was increased in comparison with positive control group ( $H_2O_2$ ) ( $p < 0.05$ ). In 3h time; in Cherry + Peach +  $H_2O_2$  group cell growth



**Figure 1.** The growing of *Saccharomyces cerevisiae* in Strawberry and Banana fruit juices at different hours.

**Table 1.** *Saccharomyces cerevisiae* cell growth in Strawberry and Banana fruit juices.

	1h	3h	5h	Overnight
Control	0,77±0,00 <sup>a</sup>	1,25±0,00 <sup>a</sup>	1,70±0,01 <sup>a</sup>	2,02±0,00 <sup>a</sup>
Strawberry + $H_2O_2$	0,64±0,00 <sup>b</sup>	0,68±0,00 <sup>b</sup>	0,73±0,02 <sup>b</sup>	1,77±0,01 <sup>c</sup>
Banana + $H_2O_2$	0,59±0,00 <sup>c</sup>	0,62±0,00 <sup>b</sup>	0,59±0,00 <sup>c</sup>	1,74±0,00 <sup>c</sup>
Strawberry + Banana + $H_2O_2$	0,59±0,01 <sup>c</sup>	0,65±0,00 <sup>b</sup>	0,70±0,00 <sup>b</sup>	1,80±0,00 <sup>b</sup>
Positive control ( $H_2O_2$ )	0,59±0,01 <sup>c</sup>	0,62±0,01 <sup>b</sup>	0,61±0,02 <sup>b</sup>	1,61±0,01 <sup>d</sup>

*a, b, c, d; among the groups which bearing of different letter are significant ( $p < 0.05$ ). Anova Post Hoc LSD Test*

**Table 2.** *Saccharomyces cerevisiae* cell growth in Apple and Watermelon fruit juices.

	1h	3h	5h	Overnight
Control	0,67±0,00 <sup>d</sup>	1,08±0,00 <sup>a</sup>	1,54±0,00 <sup>a</sup>	2,00±0,00 <sup>a</sup>
Apple + H <sub>2</sub> O <sub>2</sub>	0,76±0,00 <sup>b</sup>	0,76±0,00 <sup>c</sup>	0,78±0,00 <sup>c</sup>	1,88±0,00 <sup>b</sup>
Watermelon + H <sub>2</sub> O <sub>2</sub>	0,71±0,00 <sup>c</sup>	0,73±0,00 <sup>c</sup>	0,78±0,00 <sup>c</sup>	1,94±0,05 <sup>b</sup>
Apple + Watermelon + H <sub>2</sub> O <sub>2</sub>	0,80±0,00 <sup>a</sup>	0,86±0,00 <sup>b</sup>	1,01±0,00 <sup>b</sup>	2,03±0,05 <sup>a</sup>
Positive control (H <sub>2</sub> O <sub>2</sub> )	0,60±0,00 <sup>c</sup>	0,67±0,00 <sup>d</sup>	0,61±0,00 <sup>d</sup>	1,84±0,18 <sup>b</sup>

a,b,c,d,e; among the groups which bearing of different letter are significant ( $p < 0.05$ ). Anova Post Hoc LSD Test.

**Table 3.** *Saccharomyces cerevisiae* cell growth in Cherry and Peach fruit juices.

	1h	3h	5h	Overnight
Control	0,67±0,1 <sup>c</sup>	1,07±0,00 <sup>b</sup>	1,53±0,00 <sup>a</sup>	2,01±0,03 <sup>a</sup>
Cherry + H <sub>2</sub> O <sub>2</sub>	0,83±0,00 <sup>b</sup>	0,85±0,00 <sup>c</sup>	0,88±0,00 <sup>c</sup>	1,88±0,00 <sup>b</sup>
Peach + H <sub>2</sub> O <sub>2</sub>	0,86±0,00 <sup>b</sup>	0,94±0,00 <sup>c</sup>	0,95±0,00 <sup>c</sup>	1,87±0,00 <sup>b</sup>
Cherry + Peach + H <sub>2</sub> O <sub>2</sub>	1,13±0,00 <sup>a</sup>	1,17±0,00 <sup>a</sup>	1,22±0,00 <sup>b</sup>	1,80±0,00 <sup>c</sup>
Positive control (H <sub>2</sub> O <sub>2</sub> )	0,68±0,00 <sup>c</sup>	0,68±0,00 <sup>d</sup>	0,69±0,01 <sup>d</sup>	1,62±0,00 <sup>d</sup>

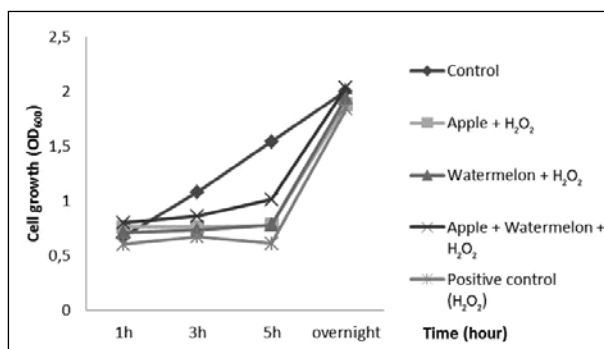
a,b,c,d; among the groups which bearing of different letter are significant ( $p < 0.05$ ). Anova Post Hoc LSD Test.

was very increased, in Cherry + H<sub>2</sub>O<sub>2</sub> group, in Peach + H<sub>2</sub>O<sub>2</sub> group cell growth was increased in comparison with positive control group (H<sub>2</sub>O<sub>2</sub>) ( $p < 0.05$ ). In 5h time; in Cherry + Peach + H<sub>2</sub>O<sub>2</sub> group cell growth was very increased, in Cherry + H<sub>2</sub>O<sub>2</sub> group, in Peach + H<sub>2</sub>O<sub>2</sub> group cell growth was increased in comparison with positive control group (H<sub>2</sub>O<sub>2</sub>) ( $p < 0.05$ ). In overnight group; in Cherry + Peach + H<sub>2</sub>O<sub>2</sub> group, in Cherry + H<sub>2</sub>O<sub>2</sub> group, in Peach + H<sub>2</sub>O<sub>2</sub> group cell growth was increased in comparison with positive control group (H<sub>2</sub>O<sub>2</sub>) ( $p < 0.05$ ). According to Yan et al. (2011) addition of H<sub>2</sub>O<sub>2</sub> can significantly induce the

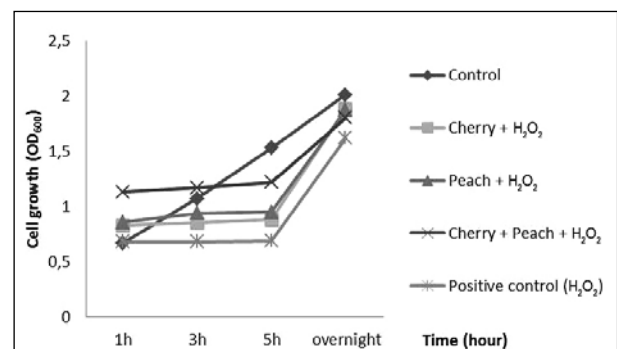
$\beta$ -carotene production and given H<sub>2</sub>O<sub>2</sub> amount more and more, in culture media calculated  $\beta$ -carotene quantity was decline in similar with reported that the catalase enzyme activity was reduced (16).

## Conclusion

In conclusion, with respect to our results, strawberry and banana, watermelon and apple, peach and cherry juice and their combination have made encourage effect on



**Figure 2.** The growing of *Saccharomyces cerevisiae* in Apple and Watermelon fruit juices at different hours.



**Figure 3.** The growing of *Saccharomyces cerevisiae* in Cherry and Peach fruit juices at different hours.

growing of the yeast cell mechanism of the *Saccharomyces* species when this fruit juices added to the culture environment in addition, we believe that it has particularly reduced oxidative damage in this way making a positive influence on yeast improving, with respect to our results, we suppose that this fruit juices possibly a like impact on human health when we imagine its effect mechanism on yeasts.

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