

Table S1. Total plate counts, yeast and mold counts, and pathogenic microbial counts of orange juice samples subjected to different doses of UV-radiation.

UV-treatments	Total plate count (log CFU/mL)		Yeast and mold count (log CFU/mL)		<i>E. coli</i> (log CFU/mL)		<i>L. plantarum</i> (log CFU/mL)		<i>S. cerevisiae</i> (log CFU/mL)	
	Population	log reduction	Population	log reduction	Population	log reduction	Population	log reduction	Population	log reduction
UV 4.68 J/cm ²	6.49±0.07 ^a	0.32±0.02	6.91±0.03 ^a	0.07±0.05	5.76±0.04 ^a	0.31±0.03	6.52±0.05 ^a	0.13±0.04	6.29±0.07 ^a	0.04±0.01
UV 9.36 J/cm ²	6.29±0.07 ^{ab}	0.53±0.02	6.78±0.01 ^{ab}	0.21±0.02	5.64±0.04 ^{ab}	0.43±0.03	6.33±0.07 ^{ab}	0.33±0.02	6.19±0.07 ^{ab}	0.14±0.02
UV 18.72 J/cm ²	5.92±0.03 ^b	0.89±0.13	6.52±0.06 ^b	0.47±0.03	5.45±0.01 ^b	0.64±0.25	6.02±0.04 ^b	0.64±0.13	5.94±0.03 ^b	0.39±0.00
UV 37.44 J/cm ²	5.55±0.08 ^c	1.26±0.01	5.99±0.01 ^c	1.00±0.02	5.32±0.05 ^c	0.77±0.22	5.53±0.36 ^c	1.12±0.45	5.50±0.08 ^c	0.85±0.03
UV 74.88 J/cm ²	5.01±0.04 ^d	1.81±0.05	5.54±0.10 ^d	1.44±0.08	4.79±0.01 ^d	1.29±0.11	4.97±0.015 ^d	1.69±0.11	4.87±0.04 ^d	1.47±0.16
UV 149.76 J/cm ²	4.26±0.05 ^e	2.56±0.04	4.94±0.00 ^e	2.05±0.02	3.11±0.03 ^e	2.97±0.46	4.16±0.022 ^e	2.49±0.07	4.23±0.05 ^e	2.10±0.21

The values in the table represent the mean ± standard deviation of UV treated orange juice obtained from the 3 replicates. ^{ae} indicating significant difference in each column ($p \leq 0.05$) of the microbial experiment. UV: ultraviolet radiation doses (J/cm²).

Table S2. Total microbial and yeast and mold counts, and microbial counts of orange juice samples subjected to different levels of nisin.

Nisin (ppm)	Total plate count (log CFU/mL)		Yeast and mold count (log CFU/mL)		<i>E. coli</i> (log CFU/mL)		<i>L. plantarum</i> (log CFU/mL)		<i>S. cerevisiae</i> (log CFU/mL)	
	Population	log reduction	Population	log reduction	Population	log reduction	Population	log reduction	Population	log reduction
50	4.92±0.13 ^a	0.85 ±0.02	7.40±0.08 ^a	0.06±0.02	6.80±0.11 ^a	0.47±0.27	5.59±0.10 ^a	0.69±0.18	7.30±0.01 ^a	0.05±0.05
100	4.64±0.02 ^b	1.14±0.08	7.32±0.05 ^a	0.14±0.05	6.31±0.24 ^{ab}	0.96±0.14	4.14±0.09 ^b	2.13±0.17	7.23±0.05 ^{ab}	0.12±0.01
150	4.18±0.15 ^c	1.59±0.04	7.26±0.04 ^{ab}	0.19±0.06	6.02±0.20 ^b	1.25±0.19	3.84±0.04 ^c	2.43±0.04	7.21±0.05 ^{ab}	0.14±0.00
200	3.66±0.16 ^d	2.12±0.05	6.23±0.04 ^b	0.23±0.06	5.72±0.27 ^b	1.55±0.11	3.23±0.01 ^d	3.05±0.07	7.17±0.02 ^b	0.18±0.04

The values in the table represent the mean ± standard deviation of nisin (ppm) treated orange juice obtained from the 3 replicates. ^{a-d} indicating significant difference in each column ($p \leq 0.05$) of the microbial experiment.

Table S3. Physiochemical characteristics of orange juice subjected to different doses of UV-radiation and nisin.

Properties	UV treatments						Nisin (ppm)			
	4.68 J/cm ²	9.36 J/cm ²	18.72 J/cm ²	37.44 J/cm ²	74.88 J/cm ²	149.76 J/cm ²	50	100	150	200
pH	3.87±0.01 ^a	3.87±0.01 ^a	3.87±0.01 ^a	3.87±0.01 ^a	3.87±0.01 ^a	3.87±0.01 ^a	3.87±0.004 ^a	3.87±0.003 ^a	3.87±0.005 ^a	3.86±0.005 ^a
TSS	9.0±0.01 ^a	9.0±0.03 ^a	9.0±0.01 ^a	9.0±0.01 ^a	9.0±0.01 ^a	9.0±0.01 ^a	8.8±0.014 ^a	8.7±0.060 ^a	8.7±0.011 ^a	8.7±0.018 ^a
TA	0.42±0.02 ^a	0.42±0.01 ^a	0.42±0.01 ^a	0.42±0.01 ^a	0.42±0.02 ^a	0.42±0.02 ^a	0.45±0.01 ^a	0.45±0.01 ^a	0.45±0.01 ^a	0.45±0.01 ^a
L*	71.94±0.04 ^a	71.91±0.06 ^a	71.89±0.06 ^a	71.87±0.05 ^a	71.83±0.05 ^a	71.81±0.06 ^a	71.96±0.03 ^a	71.91 ±0.05 ^a	71.95±0.01 ^a	71.95±0.02 ^a
a*	11.86±0.06 ^{ab}	11.90±0.05 ^a	11.96±0.09 ^a	12.00±0.12 ^a	12.05±0.12 ^a	12.11±0.12 ^a	11.80±0.08 ^{ab}	11.81±0.09 ^{ab}	11.82±0.09 ^{ab}	11.82±0.10 ^{ab}
b*	74.12±0.04 ^a	74.00±0.08 ^a	73.93±0.17 ^a	73.80±0.27 ^{ab}	73.78±0.27 ^{ab}	73.70±0.28 ^{ab}	74.26±0.02 ^a	74.26±0.05 ^a	74.27±0.02 ^a	74.27±0.04 ^a
TPC	188.08±11.85 ^a	176.00±10.04 ^b	165.48±13.74 ^c	160.06±10.50 ^{bc}	153.61±8.12 ^c	146.50±1.57 ^d	175.85±4.82 ^b	175.63±5.05 ^b	175.13±4.90 ^b	174.88±4.93 ^b
TFC	180.74±5.21 ^b	178.48±5.75 ^{bc}	176.51±5.67 ^{abc}	174.91±5.44 ^{bc}	172.16±3.19 ^c	169.23±3.77 ^d	202.30±4.37 ^a	199.30±5.80 ^a	198.04±5.69 ^a	197.35±4.62 ^{ab}
Vitamin C	39.99±2.93 ^{ab}	39.16±3.72 ^{ab}	38.55±3.31 ^{ab}	37.73±3.80 ^b	37.33±3.54 ^b	34.83±1.58 ^c	41.35±0.11 ^a	41.19±0.19 ^a	41.24±0.19 ^a	41.11±0.45 ^a
Carotenoids	12.71±0.49 ^b	13.70±0.37 ^{ab}	14.82±0.77 ^{ab}	15.68±0.14 ^a	15.92±0.32 ^a	16.21±0.12 ^a	16.18±0.06 ^a	16.05±0.09 ^a	16.02±0.09 ^a	15.95±0.11 ^a
DPPH	347.82±3.09 ^a	338.36±7.71 ^b	337.36±7.84 ^{bc}	335.73±7.07 ^{bc}	333.00±8.61 ^{bc}	328.36±2.31 ^c	338.45±12.21 ^b	337.82±12.1 ^{bc}	336.91±12.34 ^{bc}	336.00±12.1 ^{bc}
FRAP	355.04±7.07 ^a	351.88±7.07 ^{ab}	344.95±6.45 ^b	340.82±7.32 ^{bc}	328.54±6.57 ^c	317.49±3.60 ^d	346.44±1.86 ^{bc}	345.30±2.48 ^{ab}	344.42±2.73 ^b	343.11±1.36 ^{bc}

The values in the table represent the mean ± standard deviation of UV treated orange juice obtained from the 3 replicates. Values with different letters in the same row (a, b, c, d) are significantly different ($p \leq 0.05$).

TSS: Total soluble solid (°Brix); TA: Titratable acidity (% malic acid); TPC: Total phenolic compound (mg GAE/L); TFC: Total flavonoid content (mg QE/L); Total Carotenoid (µg /100 mL); DPPH assay (mM TE/100 mL); FRAP assay (mM TE/100 mL).