BUSTING THE MYTH THAT COOKING IN OLIVE OIL WILL RUIN YOUR PANS

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There is a common myth in Australia that cooking with Extra Virgin Olive Oil (EVOO) can ruin cookware, such as non-stick pans (e.g. Teflon pans).

This belief is specifically supported by some manufacturers' specifications that oils with higher smoke points are more suitable for cooking with Teflon coated (TC) pans and that EVOO could be damaging to their coating.

Interestingly, this myth only appears to be prominent in Australia, with no technical evidence to support it.

In 2019, Modern Olives Laboratory, an Australian oil specialist laboratory, conducted research to assess the suitability of various cooking oils, including EVOO, for use on TC pans.

METHODOLOGY

When cooking pans are heated, there are various reactions that occur that may have the potential to either damage the pan's quality, and/or leach chemicals into the cooked food. In order to investigate the hypothesis of whether cooking with EVOO ruins TC pans, the researchers measured the release of elements and metals from the pans when separately heated with different oils.

A model solution of water and vinegar was used to simulate the effect of cooking. Three brands of different TC pans of varying price points (Pan A - least expensive; Pan C - most expensive) were heated with the model solution of water and vinegar (WV) to study the release of chemical elements before and after 6 cycles of heating with different cooking oils. Each trial was done by triplicate. This is consistent with the method used by Lomolino et al (2016) that assessed mineral elements and metals released from cookware including TC pans.[1] The assessment of release of metals and elements from pans to investigate chemical interactions that occur when a pan is heated is also supported by methodologies reported in other research publications.[2, 3]

THE FOLLOWING COMMONLY USED COOKING OILS AVAILABLE ON AUSTRALIAN SUPERMARKET SHELVES WERE USED FOR THE PURPOSES OF THIS STUDY:

- Extra Virgin Olive Oil (EVOO)
- Olive Oil (OO)
- Canola Oil (CO)
- Grapeseed Oil (GO)
- Rice Bran Oil (RO)

For the purpose of this study, only one brand (different batches) of each oil was selected.

WV solution samples were tested for Aluminium (Al), Calcium (Ca), Chromium (Cr), Copper (Cu), Iron (Fe), Manganese (Mn), Nickel (Ni), Lead (Pb), Phosphorus (P), Strontium (Sr), Zinc (Zn), Silicon (Si), and Silicon Dioxide (SiO2). These are common metals and elements tested for in studies of a similar nature.[1]

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RESULTS & DISCUSSION

When combining all TC pans, no statistically significant differences were found between the final WV solutions from pans treated with the different oils. This indicates there is no significant difference between the volume of metals released from the cookware when various cooking oils were used. Hence, the various cooking oils had no effect on the pans' integrity and quality when cooking.

Differences of statistical significance for Ca, Cu, Fe, P, Zn and SiO_2 were observed however between the different TC pan types. Higher values of these metals were observed in the most expensive pan compared with the cheapest TC pan. For example, Ca average values (including initial and final treatment) in pan C were ~2.92mg/L vs ~1.75 mg/L in pan A and ~2.42 mg/L in pan B (Figure 1). Reasons for these results are not known, however, it is worth noting that the differences in values between pans are more significant than any difference between oil treatments.

When considering the analysis of the data for each brand of TC pan, the only statistical differences between initial and final treatments were with P levels using rice bran oil in the average priced Teflon coated pan (4.7mg/L vs 2.5mg/L). Silicon dioxide was not detected before treatment and significantly increased using olive (1.1mg/L) and grapeseed (1.03mg/L) oils in the lowest priced TC pan. Again, reasons for these results are not known.

After all treatments, no visual deterioration of any of the TC pans was observed. These results are limited considering the lifetime of the TC pan, but they indicate no impact of the oils' type on the integrity of the cooking pans and that EVOO is equally suitable to other oils under normal cooking conditions.

Full results are available via Appendix 1.

Figure 1: average calcium values between each TC pan type. The results showed significantly higher differences in metal leaching between pans, rather than between the treatments with the different oils.

CONCLUSION

Although there is a myth that cooking with EVOO ruins Teflon coated pans, there is no technical evidence or published scientific research that supports this. This research study provides scientific evidence that cooking with EVOO does not ruin non-stick Teflon coated pans at any different rate than other cooking oils. Significantly higher differences in metal leaching were observed between pans, rather than between the treatments with the different oils. In no case, did the use of EVOO lead to the release of significantly higher levels of metallic substances from the pan than when using any other oils.

REFERENCES

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APPENDIX 1 – RESULTS DATA TABLES
TABLE 1

Average value of elements and metals, expressed as mg/L, released from **all pans** before and after 6 cycles of heating with different cooking oils.

Element (mg/L)	Plain WV solutions*		Initial pan treatment with WV solution**		Final pan treatment with WV solution (after 6 cycles of heating each oil in its pan)									
					EVOO		OO		RO		CO		GO	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Al	0.004	0.000	0.027	0.020	0.010	0.010	0.012	0.011	0.016	0.019	0.014	0.016	0.010	0.010
Ca	1.800a	0.000	2.600	0.650	2.245	0.552	2.322	0.467	2.422	0.750	2.300	0.617	2.300	0.533
Cr	0.001	0.000	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.000	0.001	0.000
Cu	0.016a	0.000	0.082	0.100	0.014	0.002	0.010	0.003	0.013	0.006	0.015	0.008	0.012	0.004
Fe	0.012a	0.000	0.153	0.235	0.005	0.004	0.007	0.007	0.007	0.005	0.008	0.005	0.006	0.006
Pb	0.002	0.000	0.006	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002
Mn	0.001	0.000	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Ni	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
P	2.450a	0.000	3.640	0.550	3.400	0.633	3.445	0.555	3.667	0.921	3.500	0.721	3.478	0.611
Si	0.395	0.000	0.593	0.072	0.535	0.075	0.543	0.066	0.570	0.115	0.546	0.093	0.544	0.072
SiO2	0.000a	0.000	1.260	0.144	1.033	0.318	1.156	0.126	1.111	0.400	1.056	0.369	1.156	0.184
Sr	0.005	0.000	0.006	0.002	0.006	0.002	0.006	0.001	0.006	0.002	0.005	0.002	0.005	0.002
Zn	0.007a	0.000	0.080	0.095	0.002	0.001	0.002	0.001	0.003	0.001	0.017	0.023	0.003	0.002

**Level of element with water vinegar solution prior to any heat treatment*
***Level of element with heated water vinegar solution prior to any oil use*
Each mean is the value of 3 different brands of varying price points.
Same letter within a raw per metal shows insignificant difference ($p < 0.5$).

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TABLE 2

Average value of elements and metals, expressed as mg/L, released from **Pan A** before and after 6 cycles of heating with different cooking oils.

Element (mg/L)	Plain WV solutions*		Initial pan treatment with WV solution**		Final pan treatment with WV solution (after 6 cycles of heating each oil in its pan)									
					EVOO		OO		RO		CO		GO	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Al	0.004	0.006	0.006	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ca	1.800	0.000	1.860	0.134	1.667	0.058	1.867	0.115	1.667	0.115	1.667	0.058	1.767	0.058
Cr	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.001	0.000
Cu	0.016	0.014	0.035	0.021	0.014	0.006	0.010	0.004	0.010	0.001	0.023	0.018	0.013	0.003
Fe	0.012	0.015	0.026	0.006	0.010	0.001	0.015	0.002	0.012	0.002	0.012	0.002	0.013	0.001
Pb	0.002	0.002	0.003	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.004
Mn	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000
Ni	0.000	0.000	0.002	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
P	2.450a	0.071	3.100	0.122	2.867	0.153	3.000b	0.000	2.933	0.058	2.900	0.000	3.000b	0.173
Si	0.395	0.035	0.528	0.022	0.477	0.021	0.503	0.006	0.480	0.017	0.470	0.010	0.493	0.025
SiO2	0.000a	0.000	1.140	0.055	0.700	0.608	1.100	0.000	0.700	0.608	0.667	0.577	1.033	0.058
Sr	0.005	0.000	0.004	0.001	0.004	0.000	0.005	0.001	0.004	0.000	0.004	0.000	0.004	0.001
Zn	0.007	0.009	0.019	0.004	0.002	0.000	0.003	0.004	0.003	0.002	0.043	0.066	0.005	0.004

**Level of element with water vinegar solution prior to any heat treatment*
***Level of element with heated water vinegar solution prior to any oil use*
Each mean is the value of 3 different brands of varying price points.
Same letter within a raw per metal shows insignificant difference ($p < 0.5$).

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TABLE 3

Average value of elements and metals, expressed as mg/L, released from Pan B after 6 cycles of heating with different cooking oils.

Element (mg/L)	Plain WV solutions*		Initial pan treatment with WV solution**		Final pan treatment with WV solution (after 6 cycles of heating each oil in its pan)									
					EVOO		OO		RO		CO		GO	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Al	0.004	0.006	0.029	0.011	0.011	0.002	0.014	0.003	0.012	0.001	0.011	0.001	0.010	0.001
Ca	1.800a	0.000	2.860	0.219	2.300	0.173	2.300	0.100	2.433	0.208	2.333	0.115	2.300	0.173
Cr	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000
Cu	0.016	0.014	0.196	0.036	0.012	0.005	0.008	0.002	0.008	0.003	0.008	0.003	0.008	0.003
Fe	0.012	0.015	0.008	0.004	0.002	0.000	0.002	0.000	0.002	0.000	0.002	0.000	0.002	0.000
Pb	0.002	0.002	0.015	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mn	0.001	0.000	0.003	0.001	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000
Ni	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
P	2.450a	0.071	3.620	0.327	3.233	0.231	3.267	0.153	3.367	0.321	3.300	0.173	3.267	0.289
Si	0.395	0.035	0.580	0.048	0.507	0.029	0.507	0.025	0.530	0.044	0.517	0.023	0.513	0.040
SiO2	0.000a	0.000	1.220	0.110	1.067	0.115	1.067	0.058	1.133	0.115	1.100	0.000	1.067	0.115
Sr	0.005	0.000	0.007	0.001	0.006	0.001	0.006	0.001	0.006	0.001	0.005	0.000	0.005	0.000
Zn	0.007	0.009	0.190	0.033	0.001	0.002	0.002	0.001	0.003	0.001	0.004	0.003	0.001	0.000

**Level of element with water vinegar solution prior to any heat treatment*
***Level of element with heated water vinegar solution prior to any oil use*
Each mean is the value of 3 repeated trials.
Same letter within a raw per metal shows insignificant difference ($p < 0.5$).

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TABLE 4

Average value of elements and metals, expressed as mg/L, released from Pan C after 6 cycles of heating with different cooking oils.

Element (mg/L)	Plain WV solutions*		Initial pan treatment with WV solution**		Final pan treatment with WV solution (after 6 cycles of heating each oil in its pan)									
					EVOO		OO		RO		CO		GO	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Al	0.004	0.006	0.045	0.010	0.019	0.008	0.022	0.002	0.037	0.018	0.032	0.023	0.019	0.009
Ca	1.800a	0.000	3.080	0.249	2.767	0.115	2.800	0.600	3.167	0.603	2.900	0.300	2.833	0.115
Cr	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000
Cu	0.016	0.014	0.014	0.002	0.016	0.012	0.013	0.006	0.020	0.019	0.014	0.012	0.016	0.013
Fe	0.012	0.015	0.424a	0.100	0.003	0.001	0.003	0.002	0.006	0.003	0.009	0.005	0.003	0.001
Pb	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mn	0.001	0.000	0.002	0.001	0.002	0.000	0.002	0.000	0.002	0.000	0.002	0.000	0.002	0.000
Ni	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
P	2.450a	0.071	4.200	0.367	4.100	0.100	4.067	0.902	4.700b	0.854	4.300	0.500	4.167	0.058
Si	0.395	0.035	0.670	0.054	0.620	0.026	0.620	0.130	0.700	0.125	0.650	0.075	0.627	0.015
SiO2	0.000a	0.000	1.420	0.130	1.333	0.058	1.300	0.300	1.500	0.300	1.400	0.200	1.367	0.058
Sr	0.005	0.000	0.008	0.001	0.007	0.001	0.007	0.002	0.008	0.002	0.007	0.001	0.007	0.000
Zn	0.007	0.009	0.031	0.016	0.003	0.003	0.002	0.001	0.004	0.004	0.003	0.002	0.002	0.001

**Level of element with water vinegar solution prior to any heat treatment*
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