Effects of dietary chia polyphenols on fatty acid profile of eggs in heat-stressed Japanese quails
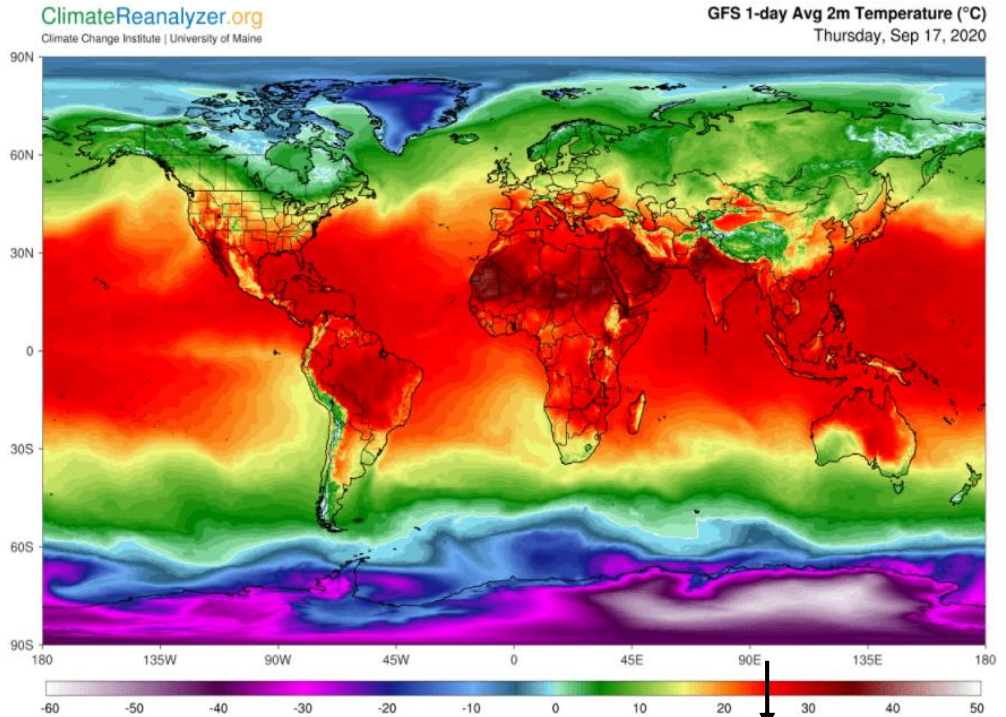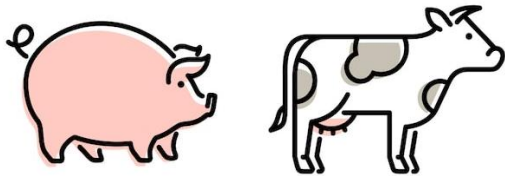
Agustín Lucini Mas[1,2], Rocío Inés Bonansea[1,2], Maria Emilia Fernandez[3,4], Jackelyn Melissa Kembro[3,4], Maria Carla Labaque[3,4], Daniel Alberto Wunderlin[1,2] and María Verónica Baroni[1,2]*

Córdoba, Argentina

1. Institute of Food Science and Techology Córdoba (ICYTAC-CONICET).
2. Organic Chemistry Department, Faculty of Chemical Sciences, National University of Córdoba.
3. Institute of Food Science and Techology (ICTA). Faculty of Exacts, Physical and Natural Sciences, National University of Córdoba.
4. Institute of Biological and Technological Investigations (IIByT-CONICET).

ICYTAC CONICET U N C   UNC   ICTA   IIBYT CONICET U N C

ClimateReanalyzer.org
Climate Change Institute | University of Maine

GFS 1-day Avg 2m Temperature (°C)
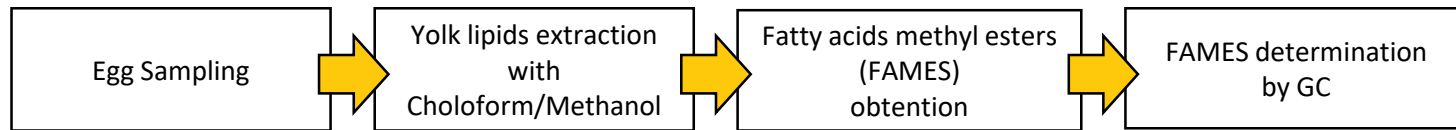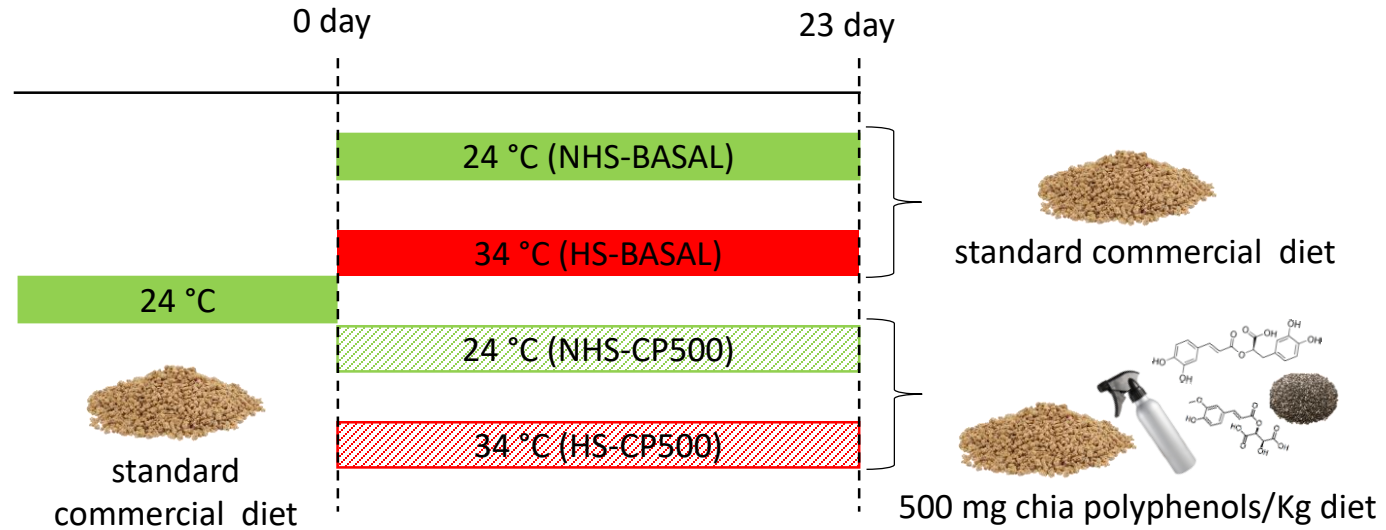Thursday, Sep 17, 2020

Thermoneutrality

Objective

Study the effects of dietary supplementation with polyphenols from defatted chia seed cake on the fatty acids composition of eggs from Japanese quail exposed to heat stress
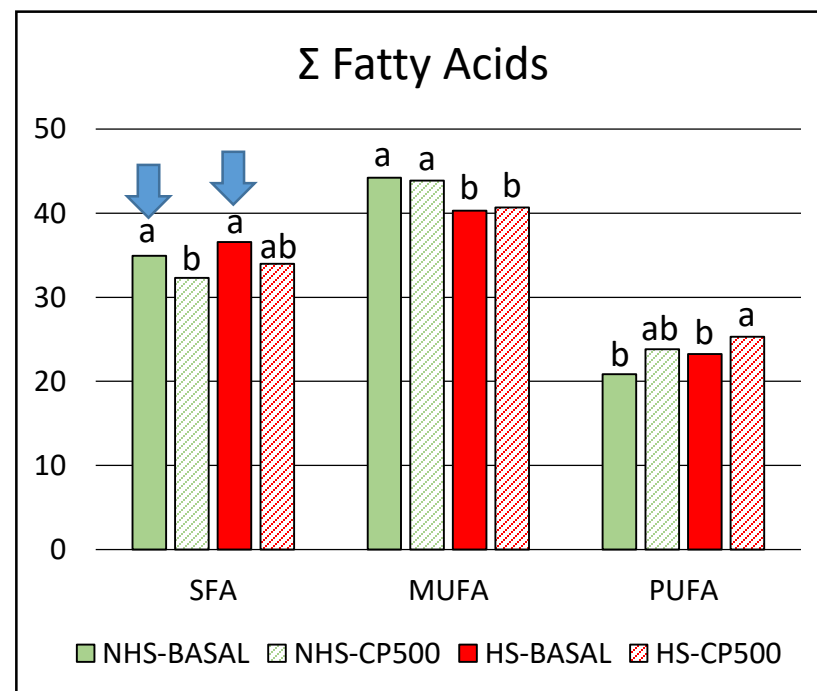
Results

	NHS		HS	
	BASAL	**CP500**	**BASAL**	**CP500**
C12:0	0.013[ab]	0.009[b]	0.023[a]	0.017[ab]
C13:0	0.017[ab]	0.013[b]	0.021[ab]	0.014[b]
C14:0	0.326	0.317	0.385	0.373
C15:0	0.029	0.018	0.034	0.028
C16:0	23.012[a]	20.747[b]	23.404[a]	22.207[ab]
C17:0	0.143[a]	0.071[b]	0.152[a]	0.110[ab]
C18:0	11.384	11.107	12.550	11.233
C20:0	0.013[b]	0.017[b]	0.035[a]	0.018[b]
Σ SFA	34.938[a]	32.297[b]	36.603[a]	34.000[ab]
C14:1	0.044	0.050	0.068	0.029
C16:1	3.229[a]	3.030[ab]	3.009[ab]	2.353[b]
C17:1	0.025	0.022	0.060	0.027
C18:1	40.898[a]	40.710[a]	37.055[b]	38.203[b]
C20:1	0.088	0.073	0.125	0.084
Σ MUFA	44.284[a]	43.887[a]	40.317[b]	40.700[b]
C18:2	17.198[b]	18.877[ab]	19.062[ab]	19.633[a]
C18:3	0.578[b]	0.783[ab]	0.826[ab]	1.193[a]
C20:4	2.685[b]	3.460[a]	2.387[b]	3.577[a]
C20:5	0.044[bc]	0.067[a]	0.042[c]	0.057[ab]
C22:4	0.075[b]	0.154[ab]	0.176[ab]	0.225[a]
C22:6	0.197[b]	0.477[a]	0.588[a]	0.617[a]
Σ PUFA	20.778[b]	23.817[ab]	23.080[b]	25.300[a]

Σ Fatty Acids

Results are expressed as mean.
Values without letters did not show significant differences between any treatment.
Values with no letter in common are significantly different ($p < 0.05$) between different treatments.

Results

	NHS		HS	
	BASAL	**CP500**	**BASAL**	**CP500**
C12:0	0.013[ab]	0.009[b]	0.023[a]	0.017[ab]
C13:0	0.017[ab]	0.013[b]	0.021[ab]	0.014[b]
C14:0	0.326	0.317	0.385	0.373
C15:0	0.029	0.018	0.034	0.028
C16:0	23.012[a]	20.747[b]	23.404[a]	22.207[ab]
C17:0	0.143[a]	0.071[b]	0.152[a]	0.110[ab]
C18:0	11.384	11.107	12.550	11.233
C20:0	0.013[b]	0.017[b]	0.035[a]	0.018[b]
Σ SFA	34.938[a]	32.297[b]	36.603[a]	34.000[ab]
C14:1	0.044	0.050	0.068	0.029
C16:1	3.229[a]	3.030[ab]	3.009[ab]	2.353[b]
C17:1	0.025	0.022	0.060	0.027
C18:1	40.898[a]	40.710[a]	37.055[b]	38.203[b]
C20:1	0.088	0.073	0.125	0.084
Σ MUFA	44.284[a]	43.887[a]	40.317[b]	40.700[b]
C18:2	17.198[b]	18.877[ab]	19.062[ab]	19.633[a]
C18:3	0.578[b]	0.783[ab]	0.826[ab]	1.193[a]
C20:4	2.685[b]	3.460[a]	2.387[b]	3.577[a]
C20:5	0.044[bc]	0.067[a]	0.042[c]	0.057[ab]
C22:4	0.075[b]	0.154[ab]	0.176[ab]	0.225[a]
C22:6	0.197[b]	0.477[a]	0.588[a]	0.617[a]
Σ PUFA	20.778[b]	23.817[ab]	23.080[b]	25.300[a]

Σ Fatty Acids

Results are expressed as mean.
Values without letters did not show significant differences between any treatment.
Values with no letter in common are significantly different (p < 0.05) between different treatments.
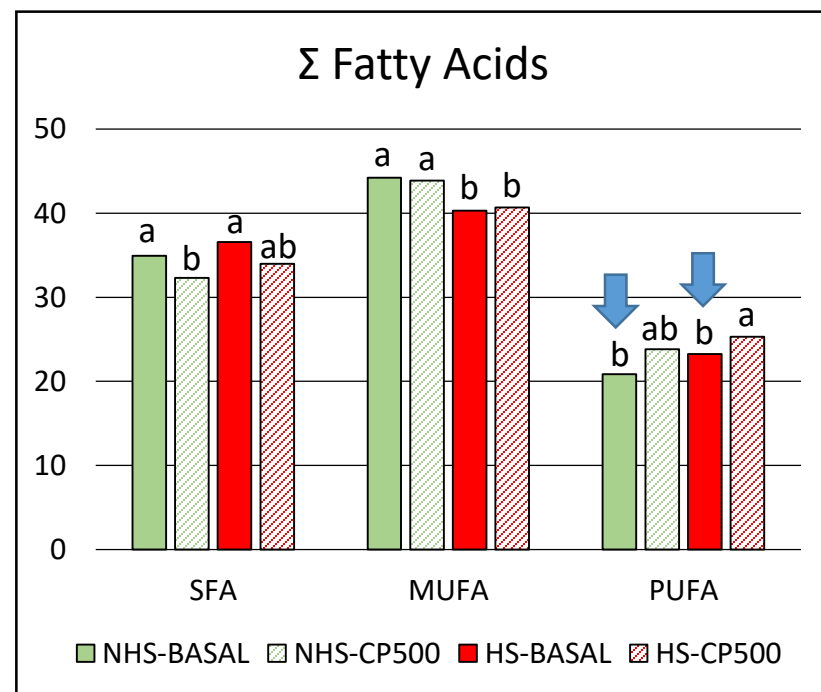
Results

	NHS		HS	
	BASAL	**CP500**	**BASAL**	**CP500**
C12:0	0.013[ab]	0.009[b]	0.023[a]	0.017[ab]
C13:0	0.017[ab]	0.013[b]	0.021[ab]	0.014[b]
C14:0	0.326	0.317	0.385	0.373
C15:0	0.029	0.018	0.034	0.028
C16:0	23.012[a]	20.747[b]	23.404[a]	22.207[ab]
C17:0	0.143[a]	0.071[b]	0.152[a]	0.110[ab]
C18:0	11.384	11.107	12.550	11.233
C20:0	0.013[b]	0.017[b]	0.035[a]	0.018[b]
Σ SFA	34.938[a]	32.297[b]	36.603[a]	34.000[ab]
C14:1	0.044	0.050	0.068	0.029
C16:1	3.229[a]	3.030[ab]	3.009[ab]	2.353[b]
C17:1	0.025	0.022	0.060	0.027
C18:1	40.898[a]	40.710[a]	37.055[b]	38.203[b]
C20:1	0.088	0.073	0.125	0.084
Σ MUFA	44.284[a]	43.887[a]	40.317[b]	40.700[b]
C18:2	17.198[b]	18.877[ab]	19.062[ab]	19.633[a]
C18:3	0.578[b]	0.783[ab]	0.826[ab]	1.193[a]
C20:4	2.685[b]	3.460[a]	2.387[b]	3.577[a]
C20:5	0.044[bc]	0.067[a]	0.042[c]	0.057[ab]
C22:4	0.075[b]	0.154[ab]	0.176[ab]	0.225[a]
C22:6	0.197[b]	0.477[a]	0.588[a]	0.617[a]
Σ PUFA	20.778[b]	23.817[ab]	23.080[b]	25.300[a]

Σ Fatty Acids

Legend: ☐ NHS-BASAL ☐ NHS-CP500 ■ HS-BASAL ☒ HS-CP500

Results are expressed as mean.
Values without letters did not show significant differences between any treatment.
Values with no letter in common are significantly different (p < 0.05) between different treatments.
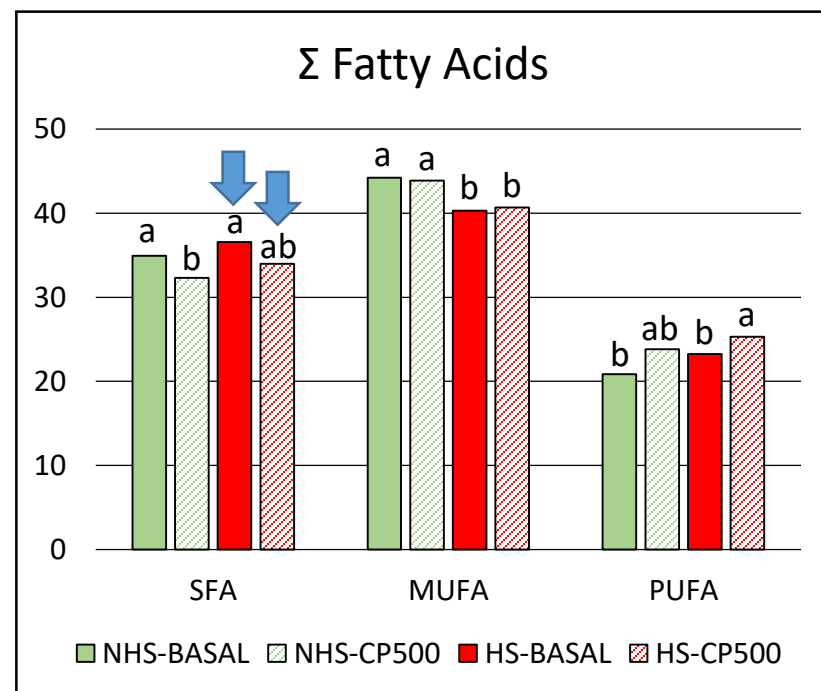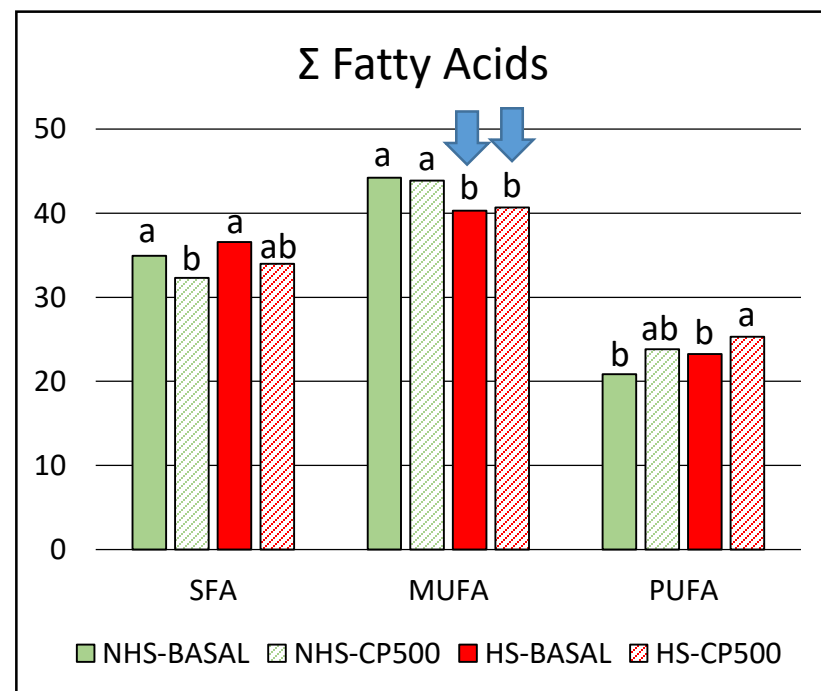
Results

	NHS		HS	
	BASAL	**CP500**	**BASAL**	**CP500**
C12:0	0.013^{ab}	0.009^{b}	0.023^{a}	0.017^{ab}
C13:0	0.017^{ab}	0.013^{b}	0.021^{ab}	0.014^{b}
C14:0	0.326	0.317	0.385	0.373
C15:0	0.029	0.018	0.034	0.028
C16:0	23.012^{a}	20.747^{b}	23.404^{a}	22.207^{ab}
C17:0	0.143^{a}	0.071^{b}	0.152^{a}	0.110^{ab}
C18:0	11.384	11.107	12.550	11.233
C20:0	0.013^{b}	0.017^{b}	0.035^{a}	0.018^{b}
Σ SFA	34.938^{a}	32.297^{b}	36.603^{a}	34.000^{ab}
C14:1	0.044	0.050	0.068	0.029
C16:1	3.229^{a}	3.030^{ab}	3.009^{ab}	2.353^{b}
C17:1	0.025	0.022	0.060	0.027
C18:1	40.898^{a}	40.710^{a}	37.055^{b}	38.203^{b}
C20:1	0.088	0.073	0.125	0.084
Σ MUFA	44.284^{a}	43.887^{a}	40.317^{b}	40.700^{b}
C18:2	17.198^{b}	18.877^{ab}	19.062^{ab}	19.633^{a}
C18:3	0.578^{b}	0.783^{ab}	0.826^{ab}	1.193^{a}
C20:4	2.685^{b}	3.460^{a}	2.387^{b}	3.577^{a}
C20:5	0.044^{bc}	0.067^{a}	0.042^{c}	0.057^{ab}
C22:4	0.075^{b}	0.154^{ab}	0.176^{ab}	0.225^{a}
C22:6	0.197^{b}	0.477^{a}	0.588^{a}	0.617^{a}
Σ PUFA	20.778^{b}	23.817^{ab}	23.080^{b}	25.300^{a}

Σ Fatty Acids

Legend: NHS-BASAL, NHS-CP500, HS-BASAL, HS-CP500

Results are expressed as mean.
Values without letters did not show significant differences between any treatment.
Values with no letter in common are significantly different ($p < 0.05$) between different treatments.
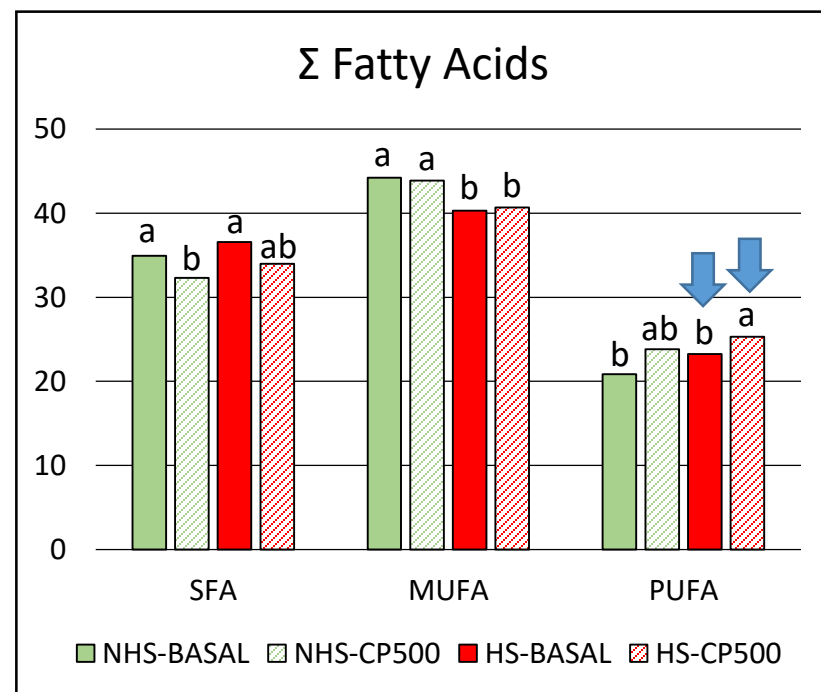
Results

	NHS		HS	
	BASAL	**CP500**	**BASAL**	**CP500**
C12:0	0.013[ab]	0.009[b]	0.023[a]	0.017[ab]
C13:0	0.017[ab]	0.013[b]	0.021[ab]	0.014[b]
C14:0	0.326	0.317	0.385	0.373
C15:0	0.029	0.018	0.034	0.028
C16:0	23.012[a]	20.747[b]	23.404[a]	22.207[ab]
C17:0	0.143[a]	0.071[b]	0.152[a]	0.110[ab]
C18:0	11.384	11.107	12.550	11.233
C20:0	0.013[b]	0.017[b]	0.035[a]	0.018[b]
Σ SFA	34.938[a]	32.297[b]	36.603[a]	34.000[ab]
C14:1	0.044	0.050	0.068	0.029
C16:1	3.229[a]	3.030[ab]	3.009[ab]	2.353[b]
C17:1	0.025	0.022	0.060	0.027
C18:1	40.898[a]	40.710[a]	37.055[b]	38.203[b]
C20:1	0.088	0.073	0.125	0.084
Σ MUFA	44.284[a]	43.887[a]	40.317[b]	40.700[b]
C18:2	17.198[b]	18.877[ab]	19.062[ab]	19.633[a]
C18:3	0.578[b]	0.783[ab]	0.826[ab]	1.193[a]
C20:4	2.685[b]	3.460[a]	2.387[b]	3.577[a]
C20:5	0.044[bc]	0.067[a]	0.042[c]	0.057[ab]
C22:4	0.075[b]	0.154[ab]	0.176[ab]	0.225[a]
C22:6	0.197[b]	0.477[a]	0.588[a]	0.617[a]
Σ PUFA	20.778[b]	23.817[ab]	23.080[b]	25.300[a]

Σ Fatty Acids

Results are expressed as mean.
Values without letters did not show significant differences between any treatment.
Values with no letter in common are significantly different ($p < 0.05$) between different treatments.
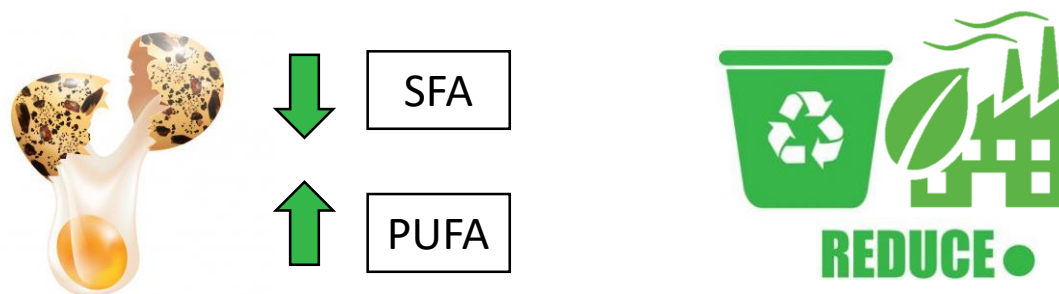
Results

	NHS		HS	
	BASAL	**CP500**	**BASAL**	**CP500**
C12:0	0.013[ab]	0.009[b]	0.023[a]	0.017[ab]
C13:0	0.017[ab]	0.013[b]	0.021[ab]	0.014[b]
C14:0	0.326	0.317	0.385	0.373
C15:0	0.029	0.018	0.034	0.028
C16:0	23.012[a]	20.747[b]	23.404[a]	22.207[ab]
C17:0	0.143[a]	0.071[b]	0.152[a]	0.110[ab]
C18:0	11.384	11.107	12.550	11.233
C20:0	0.013[b]	0.017[b]	0.035[a]	0.018[b]
Σ SFA	34.938[a]	32.297[b]	36.603[a]	34.000[ab]
C14:1	0.044	0.050	0.068	0.029
C16:1	3.229[a]	3.030[ab]	3.009[ab]	2.353[b]
C17:1	0.025	0.022	0.060	0.027
C18:1	40.898[a]	40.710[a]	37.055[b]	38.203[b]
C20:1	0.088	0.073	0.125	0.084
Σ MUFA	44.284[a]	43.887[a]	40.317[b]	40.700[b]
C18:2	17.198[b]	18.877[ab]	19.062[ab]	19.633[a]
C18:3	0.578[b]	0.783[ab]	0.826[ab]	1.193[a]
C20:4	2.685[b]	3.460[a]	2.387[b]	3.577[a]
C20:5	0.044[bc]	0.067[a]	0.042[c]	0.057[ab]
C22:4	0.075[b]	0.154[ab]	0.176[ab]	0.225[a]
C22:6	0.197[b]	0.477[a]	0.588[a]	0.617[a]
Σ PUFA	20.778[b]	23.817[ab]	23.080[b]	25.300[a]

Σ Fatty Acids

Legend: NHS-BASAL, NHS-CP500, HS-BASAL, HS-CP500

Results are expressed as mean.
Values without letters did not show significant differences between any treatment.
Values with no letter in common are significantly different ($p < 0.05$) between different treatments.

The use of defatted chia seed cake seems to be a promising sustainable strategy to improve the nutritional quality of eggs in heat-stress conditions, while decreases the amount of wastes from food industry.

SFA

PUFA

References

1. Abd El-Hack, M.E., Alagawany, M., Mahorese, K.M., Arif, M., Saeed, M., Arain, M.A., Soomro, R.N., Siyal, F.A., Fazlani, S.A., Fowler, J. Productive performance, egg quality, hematological parameters and serum chemistry of laying hens fed diets supplemented withh certain fat-soluble vitamins, individually or combined, during summer season. *Anim. Nutr*. **2019**, 5, 49–55.
2. Marchiori, M.S., Oliveira, R.C., Souza, C.F., Baldissera, M.D., Ribeiro, Q.M., Wagner, R., Gündel, S.S., Ourique, A.F., Kirinus, J.K., Stefani, L.M., Boiago, M.M., da Silva, A.S. Curcumin in the diet of quail in cold stress improves performance and egg quality. *Anim. Feed Sci. Technol.* **2019**, 254, 114192.
3. Nazar, F.N., Videla, E.A., Marin, R.H. Thymol supplementation effects on adrenocortical, immune and biochemical variables recovery in Japanese quail after exposure to chronic heat stress. *Animal* **2019**, 13, 318–325.
4. Fernández, M.E., Marin, R.H., Luna, A., Zunino, M.P., Labaque, M.C. Thymol feed supplementation in quail alters the percentages of nutritionally relevant egg yolk fatty acids: effects throughout incubation. *J. Sci. Food Agric.* **2017**, 97, 5233–5240.