

# Egg Quality: Organically Raised vs Conventionally Raised Hens

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## Introduction

Organic or pasture-raised remain attributes consumers are willing to pay for. Yet, debates about organic versus conventional eggs are often about which is better. At the same time, the viewpoints in these debates differ in the metric they use to define and measure "better." Quality could point to nutrient density. For example, the amount and type of fatty acids or the amount of protein. Quality could also be defined through the USDA egg quality standards. Still, quality might be connected to the presence of Salmonella spp. Additionally, the definition of quality might even connect to egg yolk color for some.

To date, some work has been done trying to compare the products (i.e. eggs) of organically raised hens to conventionally raised hens. Recently, Gaudare et al. (2021) showed that organically raised hens had a lower feed efficiency than conventionally raised hens. This means it takes more feed to produce the same number of eggs. Yet, organic eggs had significantly higher protein content in their yolks and albumen compared to conventional eggs (Filipiak-Florkiewicz et al., 2017).

We set out to evaluate several measures of egg quality between organically raised hens and conventionally raised hens as means to answer our research questions.

### Research Question:

Is a difference in quality between the products of organically raised and conventionally raised hens?

## Methods

We randomly collected 6 eggs each from two separate hens houses, one organically raised and the other conventionally raised. Eggs were collected for four consecutive weeks. Eggs were evaluated on the day they were collected.

Measures:

- (1) Whole egg weight (grams)
- (2) Yolk height (mm)
- (3) Yolk diameter (mm)
- (4) Albumen height (mm)
- (5) Yolk weight (grams)
- (6) Yolk color using Roche® color fan
- (7) Yolk color using digital reader
- (8) Yolk grade following USDA grading standards
- (9) Albumen grade following USDA grading standards
- (10) Final grade following USDA grading standards



Figure 1. Aerial view of yolk and albumen spread.



Figure 2. Color fan evaluating yolk color

## Results

Table 1. Descriptive Statistics

Variable	Egg*	N	Mean	Std.	SEM
Egg Weight, grams	C	24	63.85	5.2394	1.0695
	O	24	62.533	3.3355	0.6809
Yolk Weight, grams	C	24	17.107	1.567	0.3199
	O	24	17.192	1.5168	0.3096
Albumen Height, mm	C	18	1.8216	2.64236	0.6062
	O	18	2.6722	1.5457	0.36432
Yolk Height, mm	C	24	4.571	1.8033	0.3681
	O	24	3.95	1.1971	0.2444
Yolk Diameter, mm	C	24	38.842	3.6877	0.7527
	O	24	37.792	2.8856	0.589
Egg Color, Fan	C	24	9.96	1.042	0.213
	O	24	9.46	1.444	0.295
Egg Color, Digital	C	24	7.96	1.042	0.213
	O	24	7.46	1.444	0.295
Albumen Grade	C	24	5.7083	1.92194	0.39231
	O	24	7.125	1.9407	0.39614
Yolk Grade	C	24	6.2917	1.92194	0.39231
	O	24	5.8333	2.16025	0.44096
Final Grade	C	24	6.2083	1.25036	0.25523
	O	24	6.0833	1.34864	0.27529

\*C= conventional hens, O=organic hens

Table 2. Model Summaries with ANOVA significance

Predicted Variable	Sig.
Yolk Color, fan	.552
Yolk Color, digital	.552
Yolk Grade	.500
Albumen Grade	.017
Final Grade	.648

- When modeling the impact of conventional and organic eggs on measures of yolk color, yolk grade, and final grade, no statistical difference was found.
- When modeling the impact of conventional and organic eggs on the measure of albumen grade, a statistical difference was found.

Table 3. Regression Coefficients for Albumen Grade Model

Independent Variables	B Coefficient	Sig.
Egg Type	1.61	0.007
%CP	-0.809	0.255
Week	0.250	0.394

- Organic eggs had statistically higher albumen grades compared to conventional eggs when keeping crude protein levels and weeks of experiment constant.

## References

Filipiak-Florkiewicz, A., Dereń, K., Florkiewicz, A., Topolska, K., Juszcak, L., & Cieřlik, E. (2017). The quality of eggs (organic and nutraceutical vs. conventional) and their technological properties. *Poultry Science*, 96(7), 2480-2490.

Gaudaré, Ulysse, et al. "Comparing productivity and feed-use efficiency between organic and conventional livestock animals." *Environmental Research Letters* 16.2 (2021): 024012.

## Results cont.

Table 4. Egg Amino Acid & Fatty Acid Profiles

Components	Organic	Conventional
<i>Amino Acids, %</i>		
Lysine	0.85	0.84
Phenylalanine	0.63	0.61
Leucine	0.65	0.93
Isoleucine	0.51	0.49
Threonine	0.58	0.53
Valine	0.61	0.6
Histidine	0.23	0.23
Arginine	0.77	0.75
Glycine	0.41	0.39
Aspartic Acid	1.29	1.23
Serine	0.96	0.99
Glutamic Acid	1.51	1.52
Proline	0.4	0.32
Hydroxyproline	0.02	0
Alanine	0.64	0.64
Tyrosine	0.5	0.49
Total	10.86	10.56
<i>Fatty Acid, %</i>		
Omega 3	1.38	1.41
Omega 6	16.75	18.84

## Discussion

Table 5. Layer Diet Composition

Nutritional Composition	Organic Layer Diet	Conventional Layer Diet (wk 1-3)	Conventional Layer Diet (wk 4)
Protein, %	17.6	17.74	16.23
Fat, %	4.3	4.23	4.36
Fiber, %	2.55	2.63	2.49
Ca, %	4.6	4.3	4.76
Available P, %	0.42	0.39	0.36
ME Poultry, kcal/lb	1300	1309	1305
Lys, %	1	0.98	0.88
Met, %	0.45	0.39	0.37
Met+Cys, %	0.17	0.72	0.68
Sodium, %	0.17	0.17	0.18

Organic egg albumen grade may be connected to slightly higher amino acid content in organic eggs compared to conventional eggs, 10.86 versus 10.56, respectfully. However, this amino acid analysis was a one time composite of 3 eggs during one week. This snapshot cannot be confirmed to be statistically significant. Also, the lysine and methionine content of the organic diet is higher which could be what is causing the albumen grade difference.

## Conclusion

- There was no statistical significant difference between the egg weight, yolk weight, yolk height, yolk diameter, albumen height, yolk color, yolk grade, or final grade of organic eggs and conventional eggs.
- Organic eggs led to a significantly higher albumen grade compared to conventional eggs.