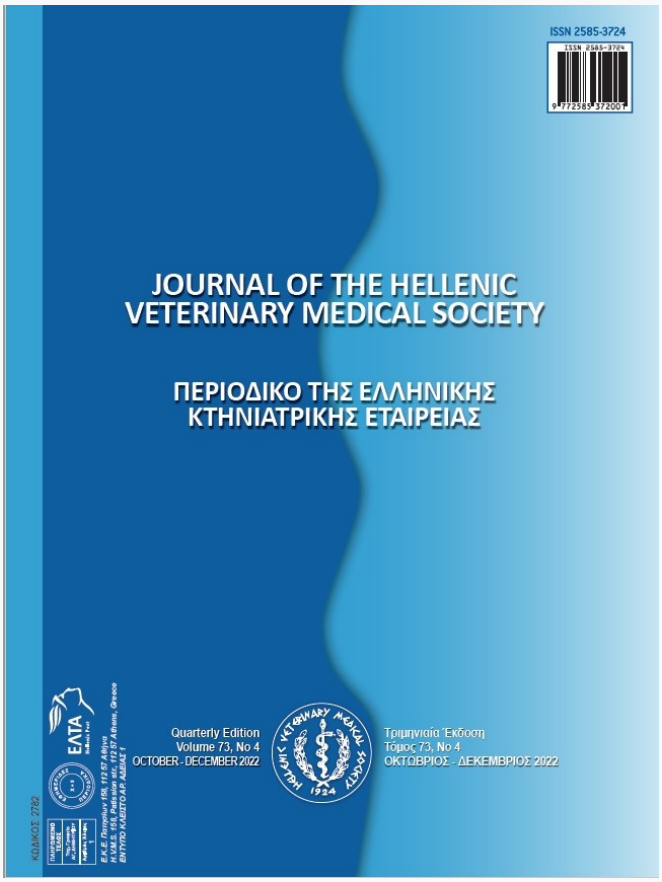
Journal of the Hellenic Veterinary Medical Society

Vol 73, No 4 (2022)



Influences of dietary aspirin supplementation on growth performance, carcass characteristics and gastrointestinal organs of broilers

Masoomeh Tavakoli, Mehrdad Bouyeh, Alireza Seidavi

doi: 10.12681/jhvms.27696

To cite this article:

Tavakoli, M., Bouyeh, M., & Seidavi, A. (2023). Influences of dietary aspirin supplementation on growth performance, carcass characteristics and gastrointestinal organs of broilers. *Journal of the Hellenic Veterinary Medical Society*, *73*(4), 5061–5066. https://doi.org/10.12681/jhvms.27696 (Original work published January 27, 2023)

J HELLENIC VET MED SOC 2022, 73 (4): 5061-5066
ΠΕΚΕ 2022, 73 (4): 5061-5066

Research article
Ερευνητικό άρθρο

Influences of dietary aspirin supplementation on growth performance, carcass characteristics and gastrointestinal organs of broilers

M. Tavakoli, M. Bouyeh, A. Seidavi

Department of Animal Science, Rasht Branch, Islamic Azad University, Rasht, Iran

ABSTRACT: This study was performed to investigate the effect of dietary aspirin (A) on some performance traits in broilers using a completely randomized design, 120 one-day-old male broiler chicks Ross 308, three levels of aspirin (0, 50 and 100 mg/kg), in 4 replicates, each including 10 chicks, during 42 days. The effects of different levels of aspirin, added to a basal diet, on performance, carcass characteristics and digestive organs of chicks were investigated. Data analysis was performed by SAS statistical software and the comparison of the means with Duncan's test. The results showed that, the chickens fed by a diet containing 100 mg/kg of aspirin had the highest feed intake and weight gain and the best feed conversion ratio compared to the other treatments. Also, the lowest production cost and the best European factor were related to treatment A100 ($P<0.05$). In addition, the use of the same level of aspirin resulted in a significant increase in some carcass properties and a decrease in ventricular fat compared to the control ($P<0.05$). So, based on the results of the present study, the use of 100 mg/kg aspirin in the diet of broilers is recommendable to improve ~~some~~ performance parameters.

Keywords: acetylsalicylic acid, carcass characteristics, performance, gastrointestinal organs, broilers

Corresponding Author:
Dr. Mehrdad Bouyeh. Department of Animal Science, Rasht Branch, Islamic Azad University, Rasht, Iran
E-mail address: booyeh@iaurasht.ac.ir

Date of initial submission: 30-7-2021
Date of acceptance: 6-10-2021

INTRODUCTION

Salicylates belong to the group of nonsteroidal anti-inflammatory drugs (Nowak 2014). Salicylates such as sodium salicylate (SS) and acetylsalicylic acid (ASA) are used in poultry industry, due to their immune system effects, analgesic properties, and anti-inflammatory activities)–(Whiting et al. 2007). However, insufficient information on tolerance levels and side effects of salicylates in poultry are not available, but Poźniaket al (2010) showed that addition of 100 and 200 mg/kg aspirin or sodium salicylate (SS) in the diet of broilers were well tolerated and showed no side effects. Acetylsalicylic acid (ASA), which is the acetylated form of salicylic acid, (Richard 2007) is the active ingredient in aspirin (Wu et al. 2016). The benefits of aspirin include minimizing gastrointestinal, respiratory disorders, and increase of growth performance, feed use, digestion, and absorption of nutrients, and the quality of meat products in broiler chickens. Aspirin inhibits the biosynthesis of prostaglandins, therefore, may be able to regulate the hypothalamus (Truong et al. 2016). In other words, aspirin inhibits the enzyme cyclooxygenase, thereby inhibiting the synthesis of prostaglandins. Rokadeet al. (2017) also reported that the use of aspirin affected feed intake and live weight gain. The feed conversion ratio (FCR), protein yield and energy efficiency all improved significantly. The relative function of thymus and bursa of Fabricius was also improved. Al-Obaidi and Al-Shadeedi(2010) reported that the use of aspirin led to improve body weight gain in broilers.

Due to the conflicting results on the effect of antioxidant compounds on the mentioned factors and since there are limited results regarding the use of this compound in the broiler growing period, so the present experiment was performed to evaluate different doses of aspirin on growth performance, carcasses characteristics and organs of the gastrointestinal tract in broilers.

MATERIALS AND METHODS

This study was conducted at a broiler farm in Masal, Iran. The experiment was performed with 120 one-day-old male chickens of commercial Ross 308 strain, with a mean weight of 45±2 g, in a completely randomized design with 3 treatments and 4 replicates and 10 chickens per pen for 42 days. The studied treatments were treatment 1 (A0mg/kg), treatment 2 (A50mg/kg) and treatment 3 (A100mg/kg) which were used in combination with the basal diet. Aspirin was used based on the intended concentrations. The

Table 1. Ingredients, chemical composition, and energy of the used diets (from 1 to 42d of age)

Ingredients (g/kg as-fed)	Starter diet (1st-10th days of age)	Grower diet (11st-24th days ofage)	Finisher diet (25th-42nd days of age)
Corn	47.03	59.60	65.99
Wheat	5.58	5.00	5.00
Soybean meal (44% crude protein)	29.02	16.15	10.28
Corn gluten	10.00	11.48	11.50
soy oil	3.50	3.40	3.09
Limestone	1.45	1.23	1.00
Di-calcium phosphate	1.95	1.80	1.83
Salt	0.20	0.20	0.20
Vitamin and mineral supplements[1]	0.50	0.50	0.50
DL-methionine	0.52	0.58	0.57
L-lysine hydrochloride	0.25	0.06	0.04
Calculated compounds			
Metabolizable energy (kcal / kg)	2950	3000	3050
Crude protein(%)	22	20	19
Lysine(%)	1.3	1.2	1.1
Methionine(%)	0.56	0.54	0.52
Met+Cys(%)	0.92	0.90	0.88
Calcium(%)Available phosphorus	1.04 0.52	0.95 0.47	0.92 0.41

1. The amount of vitamins and minerals per kg of the final diet:vitamin A, 9000 IU; vitamin D3, 3000 IU; vitamin E, 18 IU; vitamin K3, 3 mg; vitamin B1(Thiamine), 1/8 mg;vitamin B2(Riboflavin),6 mg; vitamin B6(Pyridoxine),3 mg; vitamin B12(Cyanocobalamin), 0/012 mg;vitamin B3(Niacin),30 mg; vitamin B9(Folic acid),1 mg;vitamin H3(Biotin),0/24mg;vitamin B5(Pantothenic acid),10 mg; 500 mg;Choline,100 mg;Mn,100 mg;Zinc,80 mg;Iron,10 mg; Cu,1 mg;I,0/2 mg;Selenio

diets were ground and adjusted according to the table of nutritional needs of poultry containing the minimum recommended nutrients in the Ross 308 feed guide (Manual. 2012) (Table 1). The chickens were grown in 1 m × 1 m cages on a culture of cellulose rolls for 42 days. The temperature in the breeding hall was 33 degrees Celsius in the first week and then gradually decreased to 23 degrees Celsius on the 18th day of breeding and then remained constant until the end of the period. Environmental conditions were similar for all the chicks and included 23 hours of light exposure and one hour of darkness, with room humidity of 65 to 70%. Access to water and food during the growing period was similar with free access. In addition, birds were vaccinated against infectious bronchitis (10th day of age), Newcastle disease (4th, 21st and 35th days of age) and infectious Bursal disease (12nd day of age). All vaccines were obtained from the Razi Vaccine and Serum Institute (Karaj, Iran).

Growth performance and economic efficiency

Weight gain of all the chickens of each pen in periods of 1 to 10, 11 to 24 and 25 to 42 days was calculated using a digital scale (TozinKala, Iran) with an accuracy of ±10g. At the end of each period (starter 1 to 10, grower 11 to 24 and finisher 25 to 42) the amount of feed remaining in each feeding device was weighed and deducted from the amount of the feed given at the beginning of each period, and as the result, the amount of the consumed feed was calculated. Feed conversion ratio was also calculated by dividing the amount of feed intake by weight gain for days 1 to 10, 11 to 24, 25 to 42, and the whole period (Sigoloet al. 2019).

The following formula was used to measure the European production factor:

European production factor = Average live weight (g) ×durability percentage/feed conversion ratio × number of breeding days×10

The following formula was used to measure the cost of feed consumed per kilogram of live weight. The price of aspirin at the time was used, calculated separately for each diet and included in the formula.

Feed cost for each kg of live weight= (price of feed during 42 days for each chicken in terms of IRR /weight of a chicken at 42 days of age in terms of kg)

Carcass characteristics, digestive organs and intestinal parts

At the end of the experiment, two birds of each replicate with a weight close to the mean were slaughtered and weighed using digital scales (A&D GF-300 digital scale balance, (310 gr × 0.001 gr, A&D Weighing Design and Manufacture, San Jose, CA)) with an accuracy of 0.01 g. Weights of featherless carcass, full body, empty body, abdominal fat, breast, thigh, wing, as well as internal organs (pancreas, heart, gizzard, spleen, bursa of Fabricius, liver, ventricular fat, duodenum, jejunum, and ileum) were measured (Shabaniet al. 2015).

Statistical Analysis

All data collected during the experiment and laboratory traits were analyzed by SAS statistical software based on completely randomized design (CRD). The comparison of the means was performed with Duncan's multiple-range test at 5% statistical level.

RESULTS

Growth performance

The results of the effects of using different levels of aspirin on the performance of broilers are given in Tables 2 and 3. The results showed that although weight

Table 2. Growth performance mean (±SEM) of broilers at starter, grower, finisher and whole periods of rearing fed diets containing the different levels of aspirin

	1st-10th days of age			11st-24th days of age			25th-42nd days of age			1st-42nd days of age		
Aspirin (mg/kg)	Feed intake (g/chick/day)	Weight gain (g/chick/day)	Feed conversion ratio	Feed intake (g/chick/day)	Weight gain (g/chick/day)	Feed conversion ratio	Feed intake (g/chick/day)	Weight gain (g/chick/day)	Feed conversion ratio	Feed intake (g/chick/day)	Weight gain (g/chick/day)	Feed conversion ratio
0	18.10	9.65^{b}	1.88^{a}	48.40^{b}	32.71^{b}	1.48	144.84^{b}	68.57^{b}	2.11	82.52^{b}	42.59^{b}	1.94^{a}
50	18.85	13.45^{a}	1.41^{b}	62.22^{a}	49.75^{a}	1.26	161.10^{a}	79.43^{a}	2.04	94.27^{a}	53.83^{a}	1.75^{b}
100	20.40	12.05^{a}	1.69^{a}	63.29^{a}	48.57^{a}	1.30	166.02^{a}	86.38^{a}	1.93	97.11^{a}	56.08^{a}	1.73^{b}
P-value	0.28	0.004	0.005	0.004	0.0001	0.06	0.03	0.01	0.11	0.0002	0.0001	0.0002
SEM	0.97	0.58	0.07	2.50	1.16	0.06	4.80	3.21	0.06	1.56	1.14	0.02

* Means within each column of dietary treatments with no superscript letter or at least one common superscript letter do not differ significantly (P≥0.05); SEM: Standard Error ofMeans

Table 3. Economical performance mean (±SEM) of broilers at 42nd day of age fed diets containing the different levels of aspirin

Aspirin (mg/kg)	Weight of 1 chick at 42th days of age (gr/chick)	Feed cost per kg live weight (Rial/kg)	European production index
0	1828.75[b]	52943.00[a]	224.90[b]
50	2300.73[a]	48257.90[b]	313.24[a]
100	2395.25[a]	47718.50[b]	329.24[a]
P-value	0.0001	0.0004	0.0001
SEM	47.83	622.26	9.44

[*] Means within each column ofdietarytreatments with no superscriptletter or at least one common superscriptletter do not differ significantly (P≥0.05); SEM: Standard Error of Means

gain in the period 1 to 10 days at two levels of aspirin did not show a statistically significant difference, weight gain in birds in the two aspirin treatmentswas-significantly greater compared to the control group (P<0.05) and the highest weight gain was related to A50 level. FCR (Feed conversion ratio) for the period 1 to 10 days was significant (P<0.05) greater but did not show a statistically significant difference compared to the control group. In addition, the best FCR was for the 50A level. Feed intake and weight gain of 11 to 24, 25 to 42 and 1 to 42 days statistically showed no significant difference between the two levels of aspirin, but they were significantly improved compared to the control group (P<0.05); the highest feed intake and the highest weight gain was for A100 except for the period 11 to 24 days. In addition, the best FCR of during the 25 to 42 days period was for the same level of A100. However, FCR of 1 to 42 days of age did not show any significant difference between the two levels of A, but it was significant compared to the control group; and the best FCR was related to A100.

According to the results, although the weight of one chick at 42th days of age (gr/chick), feed cost per kg live weight (Rial/kg) and the European factor were not significant at the two different levels of A, but they both showed a statistically significant difference compared to the control group (P<0.05).

Carcass characteristics, abdominal fat and digestive organs

The effect of experimental treatments on carcass characteristics is shown in Tables 4 and 5. The results showed that the two levels of aspirin were not significantlydifferent in live weight, featherless weight, full body weight, empty body weight, eviscerated carcass percentage, breast percentage, thigh percentage and ventricular fat, but both aspirin treatments were significantly improved compared with the control group (P<0.05).

Parts of intestine

The effect of experimental treatments on different parts of the intestine is shown in Table 6. The results showed that the use of two different levels of aspirin on the weight ratio of jejunum, ileum, colon and right cecum were not statistically significant different from each other, but differences the means of both other aspirin treatment groups were significant compared to the control group (P<0.05) and the highest weight ratio was related to the level A100.

Table 4. Mean (±SEM) of economically relevant carcass characteristics of broilers at 42nd day of age fed diets containing the different levels of aspirin

Aspirin (mg/kg)	Live body weight (gr)	Defeather body weight (gr)	Full abdomen carcass weight (gr)	Empty abdomen carcass weight (gr)	Eviscerated carcass (%)	crop (%)	breast (%)	thighs (%)	wings (%)	Abdominal Fat (%)	pancreas (%)
0	2267.50[b]	2031.75[b]	1869.25[b]	1596.50[b]	78.54[b]	0.44[a]	26.93[b]	21.10[b]	8.27	1.66[a]	0.32[a]
50	2737.50[a]	2547.25[a]	2374.75[a]	2120.75[a]	83.26[a]	0.35[b]	32.53[a]	28.44[a]	7.09	0.41[b]	0.21[b]
100	2772.50[a]	2565.75[a]	2413.25[a]	2143.25[a]	83.50[a]	0.39[ab]	33.90[a]	28.75[a]	6.43	0.41[b]	0.27[ab]
P-value	0.0001	0.0001	0.0001	0.0001	0.001	0.03	0.004	0.003	0.10	0.0001	0.04
SEM	53.69	53.85	56.84	54.06	0.71	0.02	1.13	1.11	0.53	0.06	0.02

[*] Means within each column of dietary treatments with no superscript letter or at least one common superscript letter do not differ significantly (P≥0.05); SEM: Standard Error of Means

Table 5. Mean (±SEM) of ventricular organ (relative weights) characteristics of broilers at 42nd day of age fed diets containing the different levels of aspirin

Aspirin (mg/kg)	gizzard (%)	heart (%)	liver (%)	proventriculus (%)
0	2.18[a]	0.75	2.56	0.49[a]
50	1.65[b]	0.45	2.48	0.39[b]
100	1.66[b]	0.48	2.61	0.40[b]
P-value	0.0008	0.05	0.87	0.004
SEM	0.07	0.08	0.18	0.02

* Means within each column of dietary treatments with no superscript letter or at least one common superscript letter do not differ significantly (P≥0.05); SEM: Standard Error of Means

Table 6. Mean (±SEM) of intestinal segments (relative weight) of broilers at 42nd day of age fed diets containing the different levels of aspirin

Aspirin (mg/kg)	rectum (%)	duodenum (%)	jejunum (%)	ileum (%)	colon (%)	right cecum (%)	left cecum (%)
0	0.24	0.73	1.30[a]	0.54[b]	0.38[a]	0.19[a]	0.19[a]
50	0.21	0.69	0.84[b]	0.66[a]	0.27[b]	0.14[b]	0.13[b]
100	0.21	2.29	0.93[b]	0.65[a]	0.30[b]	0.15[b]	0.15[ab]
P-value	0.13	0.42	0.0002	0.03	0.01	0.02	0.02
SEM	0.01	0.94	0.05	0.03	0.02	0.01	0.01

* Means within each column of dietary treatments with no superscriptletter or at least one common superscript letter do not differ significantly (P≥0.05); SEM: Standard Error of Means

DISCUSSION

Growth performance

The lowest cost of live chicken and the best European factor was related to A100 group. In fact, it seems aspirin like a vitamin, acts as an antioxidant, and by reducing the production of prostaglandins and by lowering blood viscosity caused by an increase in blood pH has a role in reducing the production of free radicals and since increasing alkalinity in the blood can lead to high blood pressure, so aspirin can have a role in maintaining the structure of the heart and dilate blood vessels thereby improving blood flow to important organs such as the liver and kidneys, resulting in an improved performance (Zhang et al. 2016). Abdel-Fattah (2006) and El-Soud et al. (2006) also reported that using aspirin supplement in the diet of broilers results in a better production performance. Similar results are reported in the findings of Jebur et al. (2018) and Rokade et al. (2017). In fact, aspirin by inhibiting the formation of free radicals and protecting against oxidative damage in tissues and liver cells improved the performance of broilers (Jebur et al. 2018).

Carcass characteristics, ventricular fat and digestive organs

According to the table, the lowest ventricular fat was related to the two levels of aspirin which is consistent with the results of Rokade et al (2017), in which it was reported that aspirin consumption could significantly reduce corticosterone and serum cholesterol and ventricular fat. Two different levels of aspirin did not significantly affect the relative weight of the pancreas (P≥0.05). In addition, the two different levels of aspirin did not have any significant effect on the relative weight of gizzard, heart, and proventriculus, but there was a statistically significant difference compared to the control group (P<0.05) which is also consistent with the findings of Rokade et al. (2017). Aspirin may have improved the performance of broiler chickens by helping to avoid bad effects of stress and inhibiting the formation of free radicals and protecting against free radical damage in liver tissues and cells (Jebur et al. 2018).

Parts of intestine

According to the findings of Jebur et al. (2017), the use of vitamins C, E, aspirin, and sodium chloride in the diet of broilers led to positive effects on digestibility, weight ratio, and some carcass characteristics, which was consistent with the findings of Stilborn et al. (1988). These results could be related to the antioxidant properties of this compound, which by removing free radicals caused by breeding conditions can lead to improving the relative weight and some carcass characteristics. The use of aspirin had no sig-

nificant effect on the relative weight of the rectum, duodenum and left cecum (P≥0.05).

CONCLUSION

In general, it could be stated that according to the present study, the use of aspirin in the diet of broilers of Ross 308 strain improved feed intake, weight gain, conversion ratio, cost per kilogram of live weight and production factor. Therefore, according to the results of this experiment, the use 100 mg/kg aspirin is recommended in the diets for growing broiler chickens as an antioxidant compound and a cheap growth stimulant.

ACKNOWLEDGMENTS

This manuscript is prepared based on PhD thesis of first author at Rasht Branch, Islamic Azad University, Rasht, Iran. Financial support by Rasht Branch, Islamic Azad University, grant number 17.16.4.18418 is gratefully acknowledged.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

Authors' contributions:

MasoomehTavakoli: Data curation, Formal analysis, Investigation, Writing-original draft

MehrdadBouyeh: Conceptualization, Investigation, Project administration, Supervision, Validation, Writing-original draft, Writing-review & editing

AlirezaSeidavi: Conceptualization, Data curation, Supervision, Writing-original draft.

Data availability: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Animal Welfare Statement:

The authors confirm that the ethical policies of the journal, as noted on the journal's author guidelines page, have been adhered to and the appropriate ethical review committee approval has been received. The authors confirm that they have followed EU standards for the protection of animals used for scientific purposes.

REFERENCES

Abdel, FS. 2006. Physiological and immunological adjustments of dietary ascorbic acid and acetyl salicylic acid in heat stressed Japanese quail. *Egyptian Poultry Science*26(4): 1395-1418.

Al-Obaidi, FA, and SM Al-Shadeedi.2010.Effect of dietary aspirin for reducing ascities and enhancing productive performance of broilers reared in high density.*Al-Qadisiya Journal of Veterinary Medicine Science* 9: 20-25.

El-Soud,SBA.,Ebeid, TA, and YZ.Eid. 2006. Physiological and antioxidative effects of dietary acetyl salicylic acid in laying Japanese quail (*Coturnix japonica*) under high ambient temperature. *The Journal of Poultry Science* 43(3): 255-265.

Jebur, SF., FM H Hussain, and TT. Mohammed.2017. The effect of adding different levels of Vitamin C, E, Aspirin and Sodium Chlorides in diet for total digestible nutrients, and some organ relative weights and carcass traits of broiler chickens during heat stress.*Al-Anbar Journal of Veterinary Sciences*10(1): 94-107.

Jebur, S., T.Mohammed, andAK.Firas. 2018.Effect of Vitamin E, C and Aspirin in the Performance, Lipid Peroxidation and Blood Biochemistry Traits of Broiler in Heat Stress. *The Eurasia Proceedings of Science Technology Engineering and Mathematics* (3): 145-151.

Manual, RB.2012. Ross 308 broiler nutrition manual. *Ross Broiler Ltd: Newbridge, Midlothian*, *UK,*

Nowak, JZ. 2014. Aspirin and age-related macular degeneration: positives versus negatives. *Expert Opinion on Drug Safety* 13(6): 687-690.

Richard, LM. 2007. The 100 most important chemical compounds: a reference guide. *ABC-CLIO*p. 10.ISBN 978-0-313-33758-1.

Rokade,JJ.,Bhanja, SK., Shinde, AS., DB Bhaisare,and AB. Mandal.2017. Evaluation of aspirin (ASA) in broiler chicken during hot dry summer using zoo technical, molecular and physio-biochemical tools. *Indian Journal of Animal Research* 51(1): 97-104.

Shabani, S., Seidavi, A., L.Asadpour, andM.Corazzin. 2015. Effects of physical form of diet and intensity and duration of feed restriction on the growth performance, blood variables, microbial flora, immunity, and carcass and organ characteristics of broiler chickens. *Livestock Science*180: 150-157.

Sigolo, S., Deldar, E., Seidavi, A., Bouyeh, M., A.Gallo.,andA. Prandini. 2019. Effects of dietary surpluses of methionine and lysine on growth performance, blood serum parameters, immune responses, and carcass traits of broilers. *Journal of Applied Animal Research* 47(1): 146-153.

Stilborn,HL., Harris,JrGC., WGBottje,and PW. Waldroup.1988. Ascorbic acid and acetylsalicylic acid (aspirin) in the diet of broilers maintained under heat stress conditions.*Poultry Science*67(8): 1183-1187.

Truong, A., Sayago,MM.,WHKutteh,and RW.Ke.2016.Subchorionic hematomas are increased in early pregnancy in women taking low-dose aspirin. *Fertility and Sterility* 105(5): 1241-1246.

Whiting,TL.,ME Drain,andDP.Rasali.2007.Warm weather transport of broiler chickens in Manitoba. II. Truck management factors associated with death loss in transit to slaughter. *The Canadian Veterinary Journal* 48(2): 148.

Wu, D., Zhang, M., Lu, Y., Tang, S., Kemper, N., J Hartung,andE. Bao.2016. Aspirin-induced heat stress resistance in chicken myocardial cells can be suppressed by BAPTA-AM in vitro. *Cell Stress and Chaperones*21(5): 817-827.

Zhang,XH., Zhu, HS., Qian, Z., Tang, S., Wu, D., N Kemper,andED. Bao.2016.The association of Hsp90 expression induced by aspirin with anti-stress damage in chicken myocardial cells. *Journal of Veterinary Science* 17(1): 35-44.