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Assessment of External and Internal Egg Quality Traits of Indigenous Siruvidai Chicken of Tamil Nadu

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ABSTRACT: A study was conducted to assess the external and internal egg quality parameters of Siruvidai chicken in Tamil Nadu. The North-Eastern part of the Tiruvannamalai district, the North-Western part of the Dharmapuri district, Ariyalur and Perambalur districts of the Cauvery Delta zone of Tamil Nadu were selected for the study. A total of 200 eggs were collected randomly from Siruvidai farmers of Tamil Nadu, covering 60- 70 eggs from each district for egg quality studies. The mean value of external egg quality traits like egg weight (g), egg length (cm), egg width (cm), volume (cm^3), shape index, specific gravity(gm/cm^3) and surface area (mm^2) of Siruvidai chicken eggs were 35.78 ± 0.30 gm, 4.89 ± 0.02 cm, 3.66 ± 0.01 cm, 33.45 ± 0.30 cm^3, 74.93 ± 0.26, 1.07 ± 0.01 gm/cm^3 and 57.57 ± 0.33mm^2respectively. The average internal egg parameters like albumin height (mm), albumin width (mm), albumin index, haugh unit, yolk height (mm), yolk width (mm), yolk index and yolk colour were 5.54 ± 0.08 mm, 77.50 ± 0.73 mm, 0.07 ± 0.002, 84.65 ± 0.57, 15.89 ± 0.14 mm, 38.13 ± 0.21 mm, 0.42 ± 0.01 and 9.18 ± 0.10 respectively. The external egg quality parameters differed significantly (P<0.05) among different districts due to environment, management, breed, age, scavenging management and the plane of nutrition.

Keywords: External and internal egg quality traits, Indigenous, Siruvidai chicken, Tamil Nadu.

INTRODUCTION

The poultry industry has reached remarkable growth in the last few decades in India, especially in the commercial aspects. During the recent past, desi chicken rearing was more popular among rural women and youths due to its attributes of hardiness, ability to utilise locally available feed, minimum requirements of care and management, and less input technology (Sharma, 2007). Native chicken contributes 12 per cent of total egg production, with a growth rate of 45.78 per cent (Basic Animal Husbandry Statistics, 2019). Backyard poultry farming plays a significant role in improving the socio–economic status, women empowerment, self-dependency, and nutritional security of the rural poor (Kumar and Mahalati 2000). India has 19 recognised breeds of poultry with a population of 109.2 million birds.

Siruvidai chicken in Tamil Nadu is unrecognised and research work on this genetic group is scanty. The unique characteristics like broodiness, mothering ability, disease tolerance, the ability to escape from predation and easy adaptability to various climatic conditions warrant documentation of the genetic group. It is believed that the eggs from Siruvidai chicken have traditionally been used for orthopaedic ailments such as fracture and hematoma and eggs fetch a higher market price in rural areas of Tamil Nadu. Attention should be given to studying and characterising the lesser-known and largely neglected ecotypes and breeds like the Siruvidai chicken, and detailed characterization of this chicken concerning its egg and hatchability traits is generally unavailable (Jamima *et al.*, 2020). Egg quality parameters are also very crucial for the market aspect, which affects grading and price as well as hatchability and chick weight. Very little research has been carried out on the egg quality parameters of Siruvidai chicken, especially under intensive system of management (Akhilesh *et al.*, 2023). Hence, this study was undertaken to study the egg quality traits and to provide base data on the egg quality traits of Siruvidai chicken in Tamil Nadu under an extensive management system.

MATERIAL AND METHODS

The North-Eastern part of the Tiruvannamalai district, North-Western part of Dharmapuri district, Ariyalur and Perambalur districts of the Cauvery delta zone of Tamil Nadu were selected for the study. A total of 200

indigenous Siruvidai chicken eggs were collected from the study area by selecting 60- 70 eggs from each district. The eggs were collected in two different locations in each district by selecting 15 eggs at the beginning and 15 eggs at the end of the laying period. The eggs were analysed individually for its egg quality traits. The external characteristics including the individual weight of an egg, egg length, egg width, eggshell colour, cleanliness, and egg volume were recorded as per the standard procedure. Egg quality parameters namely shape index, specific gravity and surface area were calculated using a standard formula. The internal egg quality parameters like albumin index, yolk index, haugh unit, yolk colour and shell thickness were also studied.

A. Data on external egg quality parameters

Individual egg weight was measured with the help of a digital weigh balance with an accuracy of 0.01 g and the average egg weight was taken as the mean egg weight of the selected district. The length and width of an egg were measured using a vernier calliper with 0.01 mm accuracy and the results were expressed in centimetres. The shell colour was categorised as dark brown, light brown and white and the data were expressed in percentage. The cleanliness of the eggs collected from different districts was recorded and the same was expressed in percentage. The shell thickness was recorded at three different locations, namely the broad, narrow end and equatorial region of the egg and the average value was noted and the same was expressed in mm.

Shape Index: The length and width of the egg were measured using a vernier calliper with 0.01 mm accuracy and the shape index was calculated using the formula provided below

$$\text{Shape index} = \frac{\text{Greatest width of the egg}}{\text{Greatest length of the egg}} \times 100$$

Specific gravity. The weight (g) and the volume (ml) of the eggs were recorded and the same was calculated using the formula given below

$$\text{Specific gravity} = \frac{\text{Weight of egg}}{\text{Volume of egg}} \times 100$$

Surface area. Surface area was calculated using the formula given below

$$\text{Surface area} = 12.6 \times \frac{\text{length} + \text{width}}{4}\ 2$$

Where, 12.6 is a constant

Data on internal egg quality characteristics. All the eggs were broken, opened on a glass plate laid evenly on the table and studied for internal egg quality traits. After breaking open the eggs, the shell membranes were removed from the shell and the thickness was measured using screw gauze with 0.001 mm accuracy. Albumin and yolk width were measured using a vernier calliper and the height of the respective parameters was measured using an Ames tripod stand micrometre. Yolk colour was assessed by using the Roche yolk colour fan and the mean value was expressed in numbers.

Albumen index.

$$\text{Albumen index} = \frac{\text{Maximum height of thick albumen (mm)}}{\text{Maximum width of thick albumen (mm)}}$$

Haugh unit. Haugh unit was calculated using the formula given below

Haugh unit = 100 log (H+7.57-1.7 $w^{0.37}$)

where w = weight of egg in grams and h = height of thick albumen in mm

Yolk index

$$\text{Yolk index} = \frac{\text{Maximum height of yolk (mm)}}{\text{Maximum diameter of yolk (mm)}}$$

The collected data were subjected to statistical analysis as per Snedecor and Cochran (1989) and the results arrived.

RESULT AND DISCUSSION

External Egg Quality Traits. The results of external egg quality characters were given in Table 1.

Egg Weight. The average egg weight of indigenous Siruvidai chicken from the selected district of Tamil Nadu was 35.78 ± 0.30 gm. Ariyalur and Perambalur districts of Tamil Nadu recorded significantly (P<0.05) lower egg weight (35.12 ± 0.40 gm) than Tiruvannamalai (36.02 ± 0.57 gm) and Dharmapuri districts (37.32 ± 0.69 gm). The results were not much different from the findings of Tantia *et al.* (2006); Sheikh *et al.* (2018). They reported that the average egg weight of Ankleshwar and indigenous chicken under the backyard system was 35.09 ± 0.14 and 35.10 ± 0.38 gm respectively. Higher values were reported in indigenous chicken of Jammu and Kashmir (51.17gm) (Singh *et al.*, 2020 a). The scavenging nature and low input feeding practices of Siruvidai chicken in Ariyalur and Perambalur districts could be the reasons for the comparatively lower egg weight as reported. Kumar *et al.* (2022) stated that egg weight was largely affected by environment, food restriction, parental average body weight and age of egg collection.

Egg Length and Width. The egg length of indigenous Siruvidai chicken of Ariyalur and Perambalur, Tiruvannamalai and Dharmapuri districts was 4.87 ± 0.02, 4.89 ± 0.03 and 4.93 ± 0.04 cm with a mean value of 4.89 ± 0.02 cm. Higher values were recorded by Kumar *et al.* (2022) in Aseel (5.16 cm), Kadaknath (5.13) and Singh *et al.* (2023) (5.4 cm). Singh *et al.* (2020 a) reported that the variation in egg length and width was due to differences in breeds.

The average egg width of Siruvidai chicken in Ariyalur and Perambalur districts (3.61 ± 0.02 cm) were significantly (P<0.01) lower than Tiruvannamalai (3.70 ± 0.02 cm) and Dharmapuri districts (3.71 ± 0.02 cm) with a mean value of 3.66 ± 0.01 cm. Similar findings were observed by Kumar *et al.* (2022) in Kadaknath chicken (3.71 cm) and Dodamani *et al.* (2023) in rural chicken of Karnataka (3.71 cm). Lower values were recorded in Nicobari fowl (35.42 mm) by Choudhari *et al.* 2014 and higher values were observed by Kumar *et al.* (2020) and Singh *et al.* (2023). The egg weight is positively correlated with egg width by Gongolo and Tanganyika (2018) and by hen age (Singh *et al.* 2020 a). Ariyalur and Perambalur districts recorded the

lowest egg weight than the remaining districts may be the reason for the lower egg width.

Egg Volume. In the present study, the mean egg volume of indigenous chicken was 33.45 ± 0.30 cm^2 and no significant difference was noticed among different districts of Tamil Nadu. The mean egg volume of chicken reared in Tiruvannamalai, Dharmapuri, Ariyalur and Perambalur districts were 33.06 ± 0.59, 34.55 ± 0.81 and 33.29 ± 0.36 respectively. On the contrary, relatively higher egg volume were recorded by Singh *et al.* (2020 a) in indigenous chicken of Jammu and Kashmir (48.66 cm^3) and Singh *et al.* 2023 (55.11 cc) in different rearing patterns.

Shape Index. The average shape index estimated for the indigenous Siruvidai chicken population of Tamil Nadu was 74.93 ± 0.26. The shape index was significantly higher (P<0.05) in Tiruvannamalai (75.85 ± 0.37) and Dharmapuri districts (75.42 ± 0.48) than in Ariyalur and Perambalur districts (74.25 ± 0.40). Similar findings were observed in Aseel birds (74.03) by Haunshi *et al.* (2013); Rajkumar *et al.* (2013) in rural chicken (74.12) of Karnataka under a scavenging management system. A lower shape index was observed by Sheik *et al.* (2018) in indigenous chicken in the backyard (72.59). Contrary to the above findings, higher values were noted by Vasanthakumar *et al.* (2023) in native chicken of Hosur (77.40) and Peruvidai chicken (77.41) of Tamil Nadu respectively. Smaller-sized eggs lead to lower egg width and length leading to a lower shape index in Ariyalur district than Tiruvannmalai and Dharmapuri district. Singh *et al.* (2020 a) reported that the shape index was directly proportional to egg width and inversely proportional to egg length.

Specific Gravity. The specific gravity of indigenous Siruvidai chicken eggs was 1.09 ± 0.01, 1.09 ± 0.02 and 1.06 ± 0.01 in Tiruvannamalai, Dharmapuri and Ariyalur and Perambalur districts of Tamil Nadu with a mean value of 1.07 ± 0.01. Ariyalur and Perambalur districts recorded significantly (P<0.01) lower specific gravity than the remaining districts. The result of this study supports the findings of Maddheshiya *et al.* (2020) who stated that the specific gravity of indigenous chicken eggs at field conditions was 1.072 ± 0.001 g/cm^3. On the other hand, lower values were recorded by (Singh *et al.* 2020 a) in indigenous chicken (1.06 gm/cm^3) of Jammu and Kashmir and Vasanthakumar *et al.* (2023) in Peruvidai chicken (1.06 gm/cm^3) of Tamil Nadu.

Surface Area. The result relevant to surface area is presented in Table 1. The mean surface area of the indigenous Siruvidai chicken egg of Tamil Nadu was 57.57 ± 0.33. There was a significant difference (P<0.05) noticed in surface area among different districts as Ariyalur and Perambalur districts (56.79 ± 0.40) recorded lower surface area than their counterparts (Tiruvannamalai - 58.15 ± 0.68 and Dharmapuri - 58.86 ± 0.75). Lower values were observed by Adeyemo *et al.* (2018) in Nigerian chicken (51.78).

Shell colour. Creamy shell colour (74.27 %) was the predominant eggshell colour noticed in Siruvidai chicken egg of Tamil Nadu followed by dark brown (17.54 %) and white (8.19 %) in colour. A similar finding was recorded by Tantia *et al.* (2006) in Ankleshwar chicken egg (65.55 %) and Singh *et al.* (2020 a) in indigenous chicken (71.88 %) of Jammu and Kashmir. On contrary to the above results, Maddheshiya *et al.* (2020) recorded dark brown as the major shell colour (51 per cent).

Cleanliness. The majority (75.44 %) of indigenous Siruvidai chicken eggs in Tamil Nadu were neat and clean, while 24. 56 per cent were dirty and a similar trend was noticed in all three districts of the study area. The findings of the study agreed with Maddheshiya *et al.* (2020) (83 %).

Shell thickness. The mean shell thickness at the narrow, equatorial and broad ends of the indigenous Siruvidai chicken egg of Tamil Nadu were 0.304 ± 0.003, 0.290 ± 0.0021 and 0.288 ± 0.003 respectively. There was a significant difference (P<0.01) noticed in shell thickness among different districts, as Ariyalur and Perambalur districts recorded lower shell thickness than their counter parts. Vij *et al.* (2006) recorded higher shell thickness in Danki (40.45 microns), Kalasthi (37.09 microns) and Ghagus (34.86 microns) and Vasanthakumar *et al.* (2023) in Peruvidai (0.34 mm) chicken of Tamil Nadu.

Internal egg quality traits. The results of internal egg quality characters were presented in Table 2.

Albumin height and width. The average albumin height of indigenous Siruvidai chicken in Tiruvannamalai, Dharmapuri, Ariyalur and Perambalur districts were 5.36 ± 0.16, 5.96 ± 0.23 and 5.49 ± 0.10 with an overall mean value of 5.54 ± 0.08 mm. Dharmapuri district recorded significantly (P<0.05) higher albumin height than the remaining districts. The findings of the study agreed with those of Kumar *et al.* (2022) who stated that the mean album in height of Kadaknath chicken under a backyard management system was 5.52 ± 0.18 mm. Lower values were recorded by Vijh *et al.* (2005) in Kalasthi chicken (4.28 mm) and Kumar *et al.* (2020) in crossbreeds (9.45 mm) in Jharkhand. Seasonal egg collection and adequate balanced nutrition in Dharmapuri district may lead to a better albumin height, as storage of eggs in hot weather reduces albumin quality.

The average albumin width of indigenous Siruvidai chicken in Tiruvannamalai, Dharmapuri, Ariyalur and Perambalur districts were 80.63 ± 1.68, 74.86 ± 1.37 and 76.67 ± 0.88 with a mean value of 77.50 ± 0.73 mm. Tiruvannamalai district recorded significantly (P<0.05) higher albumin width than the remaining districts. The result agrees with Vijh *et al.* (2005) in Kalasthi chicken (78.29 mm). Contrary to these, lower values were recorded by Kumar *et al.* (2020) in Delham red, Red cornish, Vanaraja and Gramapriya chicken eggs and their respective estimates were 60.95 ± 2.795, 71.37 ± 3.125, 68.48 ± 2.794 and 66.50 ± 2.99 mm. Improper storage and egg collection during the summer may lead to increased albumin width, which might be the reason for the higher albumin width in Tiruvannamalai and Ariyalur districts.

Albumin Index. The average albumin index of Siruvidai chicken egg from Dharmapuri district (0.08 ± 0.003) had significantly (P<0.05) higher albumin index than Tiruvannamalai (0.07 ± 0.002) and Ariyalur and Perambalur district (0.07 ± 0.002) with the mean value of 0.07 ± 0.002. Similar results were obtained by Vij *et al.* (2016) in Kauneyan chicken (0.07) from Manipur. Lower values were reported by Vijh *et al.* (2005) in Kalasthi chicken and higher values as reported by Tantia *et al.* (2006) in Anlkeshwar chicken, Rajkumar *et al.* (2013) in backyard chicken of Karnataka and Sheikh *et al.* (2018). Lower albumin width and height due to season, improper storage, and nutrition may result in a low albumin index.

Haugh unit. The average haugh unit of indigenous Siruvidai chicken in Tiruvannamalai, Dharmapuri and Ariyalur and Perambalur districts were 84.84 ± 1.26, 90.34 ± 1.18 and 82.59 ± 0.61with a mean value of 84.65 ± 0.57. Dharmapuri district recorded significantly (P<0.01) higher haugh units than the remaining districts, as very similar results were observed by Tantia *et al.* (2006) in Ankleshwar birds (83.68). Lower values were observed by Vijh *et al.* (2005) in Kalasthi chicken (68.81), Vijh *et al.* (2006) in Ghagus chicken (76.79), Rajkumar *et al.* (2013) in indigenous chicken of Karnataka (78.01) and Rajkumar *et al.* (2014) in Aseel chicken (75.98). Higher values were noted by a few researchers, like Vasanthakumar *et al.* (2023) in Peruvidai chicken (86.66) of Tamil Nadu.

Yolk height and width. The average yolk height of indigenous Siruvidai chicken in Tiruvannamalai, Dharmapuri and Ariyalur and Perambalur districts was15.48 ± 0.36, 16.95 ± 0.25 and 15.76 ± 0.15respectively with a mean value of 15.89 ± 0.14 mm. Dharmapuri district recorded significantly (P<0.01) higher yolk height than the remaining districts. The findings of the study agreed with the reports of Kumar *et al.* (2022) in backyard-reared Aseel chicken (15.30 mm) eggs from Haryana. However, higher and lower numerical values were observed by Vijh *et al.* (2005) in Kalasthi chicken (14.83 mm), Choudhuri *et al.* (2014) in Nicobari chicken (12.50 mm) and Kumar *et al.* (2020) in crossbred chicken (16.67 mm), Singh *et al.* (2020 b) in indigenous chicken (1.63 cm) respectively.

The average yolk width of indigenous Siruvidai chicken in Tiruvannamalai, Dharmapuri and Ariyalur and Perambalur districts was37.85 ± 0.43, 37.60 ± 0.54 and 38.42 ± 0.25 mm respectively with a mean value of 38.13 ± 0.21 mm as noted by Choudhuri *et al.* (2014) in Nicobari chicken eggs. Higher values were recorded by Vijh *et al.* (2005) in Kalasthi chicken (42.75 mm) and Singh *et al.* (2020 b) in indigenous chicken (4.03 cm) of Jammu and Kashmir.

Yolk index. The present finding revealed that the average yolk index of Dharmapuri district (0.45 ± 0.01) was found to be significantly (P<0.01) higher when compared to Tiruvannamalai (0.41 ± 0.01) and Ariyalur and Perambalur districts (0.41 ± 0.01) with a mean yolk index of 0.42 ± 0.01. However lower values were estimated by Vijh *et al.* (2005) in Kalasthi chicken (0.35), Tantia *et al.* (2006) in Ankleshwar breeds (0.36), Vij *et al.* (2006) in Ghagus (0.27) and Danki (0.35) breeds of chicken. Higher values were recorded by Sheikh *et al.* (2018) in indigenous chicken (0.43) under different rearing systems.

Yolk colour. The average yolk colour of Siruvidai chicken eggs reared under the backyard system of management in Tamil Nadu was 9.18 ± 0.10. Higher yolk colour indicative of the extensive and scavenging nature of Siruvidai chicken led to high yolk colour indices. Lower values observed were by Haunshi *et al.* (2013) in Aseel (6.25) and Kadaknath (6.34) under intensive rearing; Rajkumar *et al.* (2014) in Aseel chicken at 32 (7.35), 40 (8.0) and 72 (8.11) weeks of age, Hosur and Vasanthakumar *et al.* (2023) in Peruvidai chicken (7.65) of Tamil Nadu.

Table 1: External Egg Quality Traits of Siruvidai Chicken of Tamil Nadu.

Sr. No.	Parameters		Tiruvannamalai	Dharmapuri	Ariyalur and Perambalur	Total	F value
1.	Egg wight (gm)		$36.02^{ab} \pm 0.57$	$37.32^{a} \pm 0.69$	$35.12^{b} \pm 0.40$	35.78 ± 0.30	3.82^{*}
2.	Egg length (cm)		4.89 ± 0.03	4.93 ± 0.04	4.87 ± 0.02	4.89 ± 0.02	0.69^{NS}
3.	Egg width (cm)		$3.70^{a} \pm 0.02$	$3.71^{a} \pm 0.02$	$3.61^{b} \pm 0.02$	3.66 ± 0.01	8.93^{**}
4.	Egg volume (cm^3)		33.06 ± 0.59	34.55 ± 0.81	33.29 ± 0.36	33.45 ± 0.30	1.57^{NS}
5.	Shape index		$75.85^{a} \pm 0.37$	$75.42^{ab} \pm 0.48$	$74.25^{b} \pm 0.40$	74.93 ± 0.26	4.10^{*}
6.	Specific gravity (g/cm^3)		$1.09^{a} \pm 0.01$	$1.09^{a} \pm 0.02$	$1.06^{b} \pm 0.01$	1.07 ± 0.01	6.19^{**}
7.	Surface area (mm^3)		$58.15^{ab} \pm 0.68$	$58.86^{a} \pm 0.75$	$56.79^{b} \pm 0.40$	57.57 ± 0.33	3.49^{*}
8.	Cleanliness (%)	Clean	70.00	73.77	81.67	75.44	2.15^{NS}
		Dirty	30.00	26.23	18.33	24.56	
9.	Colour (%)	Light brown	68.00	85.25	68.34	74.27	7.77^{NS}
		Dark brown	24.00	11.48	18.33	17.54	
		White	8.00	3.27	13.33	8.19	
10.	Shell thickness (mm)	Narrow end	$0.322^{a} \pm 0.004$	$0.320^{a} \pm 0.005$	$0.289^{b} \pm 0.003$	0.304 ± 0.003	30.22^{**}
		Equatorial	$0.307^{a} \pm 0.004$	$0.306^{a} \pm 0.005$	$0.277^{b} \pm 0.003$	0.290 ± 0.0021	31.71^{**}
		Broad end	$0.304^{a} \pm 0.003$	$0.305^{a} \pm 0.004$	$0.272^{b} \pm 0.003$	0.288 ± 0.003	26.99^{**}

Table 2: Internal Egg Quality Traits of Siruvidai Chicken of Tamil Nadu.

Sr. No.	Parameters	Tiruvannamalai	Dharmapuri	Ariyalur and Perambalur	Total	F value
1.	Albumin height (mm)	$5.36^{b} \pm 0.16$	$5.96^{a} \pm 0.23$	$5.49^{b} \pm 0.10$	5.54 ± 0.08	3.11^{*}
2.	Albumin width (mm)	$80.63^{a} \pm 1.68$	$74.86^{b} \pm 1.37$	$76.67^{b} \pm 0.88$	77.50 ± 0.73	4.32^{*}
3.	Albumin index	$0.07^{b} \pm 0.002$	$0.08^{a} \pm 0.003$	$0.07^{b} \pm 0.002$	0.07 ± 0.002	4.26^{*}
4.	Haught unit	$84.84^{b} \pm 1.26$	$90.34^{a} \pm 1.18$	$82.59^{b} \pm 0.61$	84.65 ± 0.57	14.25^{**}
5.	Yolk height (mm)	$15.48^{b} \pm 0.36$	$16.95^{a} \pm 0.25$	$15.76^{b} \pm 0.15$	15.89 ± 0.14	6.72^{**}
6.	Yolk Width (mm)	37.85 ± 0.43	37.60 ± 0.54	38.42 ± 0.25	38.13 ± 0.21	1.25^{NS}
7.	Yolk index	$0.41^{b} \pm 0.01$	$0.45^{a} \pm 0.01$	$0.41^{b} \pm 0.01$	0.42 ± 0.01	6.32^{**}
8.	Yolk colour	8.96 ± 0.15	9.65 ± 0.19	9.14 ± 0.16	9.18 ± 0.10	2.57^{NS}

CONCLUSIONS

From the result, it was concluded that Siruvidai chicken egg quality traits were very similar to other indigenous breeds of chicken in the country. The homogenous estimates obtained indicate uniformity within the breed and the results of this study will provide first-hand information on Siruvidai chicken which will be useful in documenting of the genetic group. The difference in location had a significant influence on egg quality parameters.

FUTURE SCOPE

To determine the full profile of Siruvidai chicken eggs, further research under different rearing systems, physicochemical characteristics, nutritional quality, and nutritionally modified or enriched eggs can be done to obtain a standard profile of Siruvidai chicken eggs.

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Conflict of Interest. None.

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