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Lipid profile in chicken sperm of Italian chicken breeds

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INTRODUCTION

Lipids are a basic component of sperm, involved in its highly specialized membrane structure and functions. Sperm lipid composition is species-specific and differences have been also reported among poultry breeds or strains.

AIM

The aim of the present study was to characterize sperm lipids and quality in 5 Italian chicken breeds: Bionda Piemontese (BP), Bianca di Saluzzo (BS), Mericanel della Brianza (MB), Pepoi (Pe), Robusta maculata (RM).

MATERIALS and METHODS

- ✓ Birds were housed in individual cages in controlled environment and fed *ad libitum* a standard chicken breeder diet and fresh drinking water.
- ✓ Ejaculates were routinely collected and the following quality parameters were assessed: volume, concentration, sperm membrane integrity (SMI), total (TMS) and progressive (PMS) motility and SKA kinetic parameters (VCL, VSL, VAP, LIN, STR, WOB, ALH, BCF). Pooled semen samples were centrifuged to separate sperm pellets, then stored at -20°C until lipid analyses.
- ✓ After total lipid extraction (Folch method), major lipid classes were fractionated by thin-layer chromatography on silica gel and fatty acid (FA) composition of phospholipid (PL) was determined by gas-chromatography; free cholesterol was assessed by colorimetric kit.

RESULTS and DISCUSSION

- ✓ Significant breed differences were found in PMS and the majority of kinetic parameters (Table 1).
- ✓ RM and BP sperm were characterized by the highest and lowest values, respectively, in progressive motility, linearity (LIN), and straightness (STR) (Table 1).
- ✓ Variability in sperm lipid components was also found between RM and BP: RM sperm showed the lowest total lipid content, higher proportion of phospholipid and lower free cholesterol/phospholipids ratio (Table2).
- ✓ PL-FA composition of RM and BP sperm showed significant differences in total saturated fatty acids, n-6 polyunsaturates and n-3 polyunsaturates (Table 3).

Table 1. Sperm quality variables (LSMeans ± SE) in semen collected from *Bionda Piemontese (BP), Bianca di Saluzzo* (BS), *Mericanel della Brianza* (MB), *Pepoi (Pe)* and *Robusta Maculata (RM)* Italian chicken breeders.

Semen parameters[1]	Breed BP	BS	MB	Pe	RM
Co ($x10^9$/mL)	3.09 ± 0.39b	3.29 ± 0.32b	2.02 ± 0.56bc	4.37 ± 0.21a	1.56 ± 0.22c
SMI (%)	78.75 ± 8.28	75.51 ± 6.76	90.06 ± 11.7	92.64 ± 4.43	87.92 ± 4.78
TMS (%)	98.90 ± 9.01	81.01 ± 7.36	98.45 ± 12.74	78.10 ± 4.81	91.86 ± 5.20
PMS (%)	22.32 ± 6.57b	17.25 ± 5.36b	30.40 ± 9.29ab	18.53 ± 3.51b	40.26 ± 3.79a
VCL (µm/s)	127.6 ± 13.02a	69.14 ± 10.63bc	106.2 ± 18.41ac	56.09 ± 6.96b	79.81 ± 7.52c
VSL (µm/s)	37.01 ± 5.21ab	24.97 ± 4.25ac	35.86 ± 7.37abc	22.38 ± 2.78c	41.41 ± 3.01b
VAP (µm/s)	70.09 ± 6.98a	40.98 ± 5.70bc	62.59 ± 9.88ac	35.11 ± 3.73b	54.77 ± 4.03ac
LIN (%)	29.16 ± 3.45c	38.80 ± 2.82b	34.00 ± 4.88bc	40.97 ± 1.84b	49.04 ± 1.99a
STR (%)	52.90 ± 2.78c	62.55 ± 2.27b	57.42 ± 3.94bc	64.70 ± 1.48ab	68.28 ± 1.60a
WOB (%)	55.10 ± 5.80	61.60 ± 4.73	59.17 ± 8.20	63.16 ± 3.10	63.37 ± 3.34
ALH (µm)	5.85 ± 0.51a	3.98 ± 0.42bc	4.73 ± 0.73ac	3.33 ± 0.27c	3.72 ± 0.29c
BCF (Hz)	5.72 ± 0.49	6.53 ± 0.40	6.41 ± 0.69	7.36 ± 0.26	7.09 ± 0.29

a-c Means within a row with different letters are significantly different with $P < 0.05$.
[1] Vo, sperm volume; Co, sperm concentration; SMI, sperm membrane integrity; TMS, total motile sperm; PMS, progressive motile sperm; VCL, curvilinear velocity; VSL, straight-line velocity; VAP, average path velocity; LIN (VSL/VCL x 100), linearity; STR (VSL/VAP x 100), straightness; WOB (VAP/VCL x 100), wobble; ALH, amplitude of lateral head displacement; BCF, beat cross frequency.

Table 2. Lipid content and composition (LSMeans ± SE) in sperm of *Bionda Piemontese (BP), Bianca di Saluzzo* (BS), *Mericanel della Brianza* (MB), *Pepoi (Pe)* and *Robusta Maculata (RM)* chicken breeders.

Lipid content	Breed BP	BS	MB	Pe	RM
TL (ug/10^9 sperm)	364.2 ± 23.2b	445.1 ± 29.5a	505.5 ± 33.0a	283.2 ± 29.5c	181.9 ± 38.1d
PL (%)	32.58 ± 2.91d	33.98 ± 3.68cd	47.62 ± 4.11b	60.79 ± 3.68a	45.66 ± 4.75bc
FC (%)	31.47 ± 2.55a	18.56 ± 3.23bc	11.04 ± 3.61c	14.44 ± 3.23bc	23.81 ± 4.17ab
TG (%)	11.92 ± 1.18a	9.21 ± 1.49a	8.74 ± 1.67a	3.95 ± 1.49b	10.72 ± 1.93a
FFA (%)	17.44 ± 1.22	17.38 ± 1.55	18.90 ± 1.73	16.82 ± 1.55	13.79 ± 2.00
CE (%)	6.56 ± 2.38c	20.85 ± 1.84a	13.69 ± 2.06b	3.98 ± 1.84c	6.00 ± 2.38c
FC/PL	1.00 ± 0.09a	0.58 ± 0.12b	0.24 ± 0.13b	0.26 ± 0.12b	0.52 ± 0.15b

a-c Means within a row with different letters are significantly different with $P < 0.05$.

Table 3. Fatty acid composition of sperm phospholipid (LSMeans ± SE) in *Bionda Piemontese (BP), Bianca di Saluzzo* (BS), *Mericanel della Brianza* (MB), *Pepoi (Pe)* and *Robusta Maculata (RM)* chicken breeders.

Fatty Acid (%)	Breed BP	BS	MB	Pe	RM
C16:0	30.14 ± 1.49a	18.66 ± 1.72b	20.56 ± 1.88b	18.55 ± 1.40b	26.30 ± 1.88a
C18:0	33.34 ± 1.46a	22.49 ± 1.69c	25.34 ± 1.85bc	21.51 ± 1.38c	28.36 ± 1.85b
C18:1n-9	6.88 ± 0.62b	13.85 ± 0.71a	12.52 ± 0.78a	12.63 ± 0.58a	1.77 ± 0.78c
C20:4n-6	3.90 ± 0.73c	8.91 ± 0.67b	10.16 ± 0.73ab	9.26 ± 0.55b	11.88 ± 0.73a
C22:4n-6	10.14 ± 1.45c	20.24 ± 1.18a	15.41 ± 1.30b	19.66 ± 0.96a	18.12 ± 1.30ab
C22:6n-3	0.22 ± 0.09c	0.73 ± 0.11b	0.90 ± 0.13ab	1.09 ± 0.09a	0.94 ± 0.15ab
SFA	68.97 ± 2.89a	44.73 ± 3.34c	49.57 ± 3.66bc	44.10 ± 2.72c	57.83 ± 3.66b
MUFA	8.85± 0.66b	20.35 ± 0.77a	18.62 ± 0.84a	20.69 ± 0.63a	5.51 ± 0.84c
PUFAn-6	14.26 ± 2.15b	31.54 ± 2.48a	28.81 ± 2.72a	31.77 ± 2.02a	34.06 ± 2.72a
PUFAn-3	5.81 ± 0.43a	0.97 ± 0.49b	1.12 ± 0.54b	1.17 ± 0.41b	0.84 ± 0.54b

a-c Means within a row with different letters are significantly different with $P < 0.05$.

CONCLUSION

A peculiar association between quality and lipid components in sperm of Italian chicken breeds was found. Sperm biological differences between breeds may contribute to improve reproductive and conservation strategies.

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