

**Table S1.** Effect of SP protein fractions in three concentrations on sperm motility and kinematics parameters.

Protein fraction ( $\mu\text{g/mL}$ )	TMOT (%)	PMOT (%)	ALH ( $\mu\text{m}$ )	BCF (Hz)	LIN (%)	STR (%)	VAP ( $\mu\text{m/s}$ )	VCL ( $\mu\text{m/s}$ )	VSL ( $\mu\text{m/s}$ )	WOB (%)
H <sup>-</sup> 125	18.8 $\pm$ 3.2	17.2 $\pm$ 3.5	4.5 $\pm$ 0.06 <sup>1,b</sup>	14.1 $\pm$ 0.2	48.1 $\pm$ 0.6 <sup>2,b</sup>	87.9 $\pm$ 0.6 <sup>2,b</sup>	71.5 $\pm$ 1.05 <sup>1,b</sup>	140.1 $\pm$ 2.0 <sup>1,b</sup>	64.7 $\pm$ 1.1 <sup>b</sup>	53.1 $\pm$ 0.5 <sup>2,b</sup>
H <sup>-</sup> 250	22.7 $\pm$ 3.1	13.5 $\pm$ 3.4	3.9 $\pm$ 0.07 <sup>2,a</sup>	13.9 $\pm$ 0.3	48.6 $\pm$ 0.7 <sup>2,b</sup>	89.1 $\pm$ 0.7 <sup>2,b</sup>	62.8 $\pm$ 1.3 <sup>2,a</sup>	122.1 $\pm$ 2.5 <sup>2,a</sup>	57.6 $\pm$ 1.3 <sup>a</sup>	53.1 $\pm$ 0.6 <sup>2,b</sup>
H <sup>-</sup> 500	27.6 $\pm$ 3.8	18.5 $\pm$ 4.2	4.2 $\pm$ 0.07 <sup>2,b</sup>	13.9 $\pm$ 0.3	45.7 $\pm$ 0.8 <sup>2,b</sup>	87.9 $\pm$ 0.7 <sup>2,b</sup>	69.4 $\pm$ 1.4 <sup>1,b</sup>	140.0 $\pm$ 2.6 <sup>1,b</sup>	62.4 $\pm$ 1.4 <sup>b</sup>	50.8 $\pm$ 0.7 <sup>2,a</sup>
C	24.5 $\pm$ 3.6	22.6 $\pm$ 3.9	4.6 $\pm$ 0.07 <sup>1,b</sup>	13.9 $\pm$ 0.3	45.4 $\pm$ 0.7 <sup>2,b</sup>	86.2 $\pm$ 0.7 <sup>2,a</sup>	71.0 $\pm$ 1.3 <sup>2,b</sup>	141.1 $\pm$ 2.4 <sup>1,b</sup>	63.5 $\pm$ 1.3 <sup>b</sup>	51.2 $\pm$ 0.6 <sup>2,a</sup>
H <sup>+</sup> 125	21.7 $\pm$ 4.4	21.6 $\pm$ 4.8	4.4 $\pm$ 0.2 <sup>1,b</sup>	15.3 $\pm$ 0.8	57.0 $\pm$ 1.9 <sup>1,b</sup>	93.6 $\pm$ 1.8 <sup>1,b</sup>	73.1 $\pm$ 3.4 <sup>1,b</sup>	125.4 $\pm$ 6.4 <sup>2,a</sup>	68.9 $\pm$ 3.5 <sup>b</sup>	60.1 $\pm$ 1.6 <sup>1,b</sup>
H <sup>+</sup> 250	28.6 $\pm$ 4.4	14.5 $\pm$ 4.8	4.2 $\pm$ 0.09 <sup>2,b</sup>	13.1 $\pm$ 0.4	42.9 $\pm$ 1.0 <sup>2,a</sup>	84.9 $\pm$ 0.9 <sup>2,a</sup>	64.1 $\pm$ 1.7 <sup>2,a</sup>	131.2 $\pm$ 3.3 <sup>2,b</sup>	56.7 $\pm$ 1.8 <sup>a</sup>	49.3 $\pm$ 0.8 <sup>2,a</sup>
H <sup>+</sup> 500	25.3 $\pm$ 6.2	14.4 $\pm$ 6.8	4.1 $\pm$ 0.1 <sup>2,a</sup>	14.5 $\pm$ 0.6	49.8 $\pm$ 1.6 <sup>2,b</sup>	90.0 $\pm$ 1.5 <sup>1,b</sup>	66.9 $\pm$ 2.8 <sup>1,a</sup>	130.3 $\pm$ 5.2 <sup>1,a</sup>	60.5 $\pm$ 2.8 <sup>a</sup>	54.1 $\pm$ 1.3 <sup>2,b</sup>

C control group; H<sup>-</sup> heparin-non-binding fraction in concentrations 125  $\mu\text{g/mL}$ , 250  $\mu\text{g/mL}$ , 500  $\mu\text{g/mL}$ ; H<sup>+</sup> heparin binding fraction in concentrations 125  $\mu\text{g/mL}$ , 250  $\mu\text{g/mL}$ , 500  $\mu\text{g/mL}$ ; TMOT total motility, PMOT progressive motility

1,2 indexes indicate significant differences ( $p < 0.05$ ) from the highest value (grey colour) of kinematic parameter in all groups

a,b indexes indicate significant differences ( $p < 0.05$ ) from the lowest value (blue colour) of kinematic parameter in all groups

**Table S2.** Effect of SP protein fractions in three concentrations on distribution of motile sperm to subpopulations (slow, medium, fast).

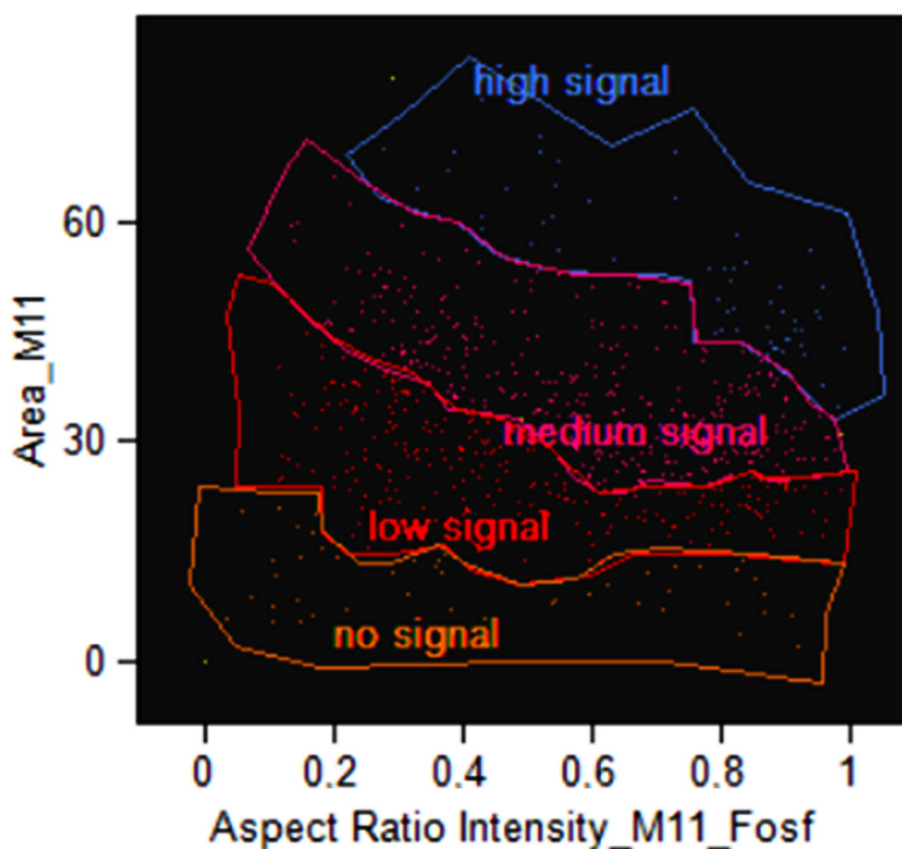
protein fraction	concentration	subpopulations		
		slow	medium	fast
H <sup>-</sup>	125 µg/mL	34.1 %	35.7 %	30.2 %
	250 µg/mL	40.3 % +++	39.4 %	20.3 % ---
	500 µg/mL	27.8 % --	44.2% +++	28.0 %
C	0	30.9 %	34.9 % -	34.3 % +++
H <sup>+</sup>	125 µg/mL	29.1 %	37.7 %	33.2%
	250 µg/mL	36.7 %	35.6 %	27.7%
	500 µg/mL	43.2 % ++	30.9 %	25.9%
C	0	30.9 %	34.9 %	34.3%

C control group, H<sup>-</sup> heparin-non-binding fraction in concentrations 125 µg/mL, 250 µg/mL, 500 µg/mL,

H<sup>+</sup> heparin binding fraction in concentrations 125 µg/mL, 250 µg/mL, 500 µg/mL

Grey and blue colour indicate the highest and lowest value of kinematic parameter in particular subpopulation, respectively

Number of + and - indicate strength of significance



**Figure S1.** IDEAS spot-dot graph to evaluate image-based flow cytometry measurement of sperm protein phosphorylation using anti-phosphotyrosine antibody (4G10).