Can semen quality be a predictor of health in working dogs?

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IWDBA DOGS SERVING HUMANITY

האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

Introduction

- The role of working dogs in Israel security.
- Direct relationship between semen and health:

  Humans- mandatory semen analysis for combat pilots (In Israel)

  Animals – mandatory semen analysis for fresh use and for shipment purposes

- In working dogs with suboptimal semen parameters – some ill a few weeks later

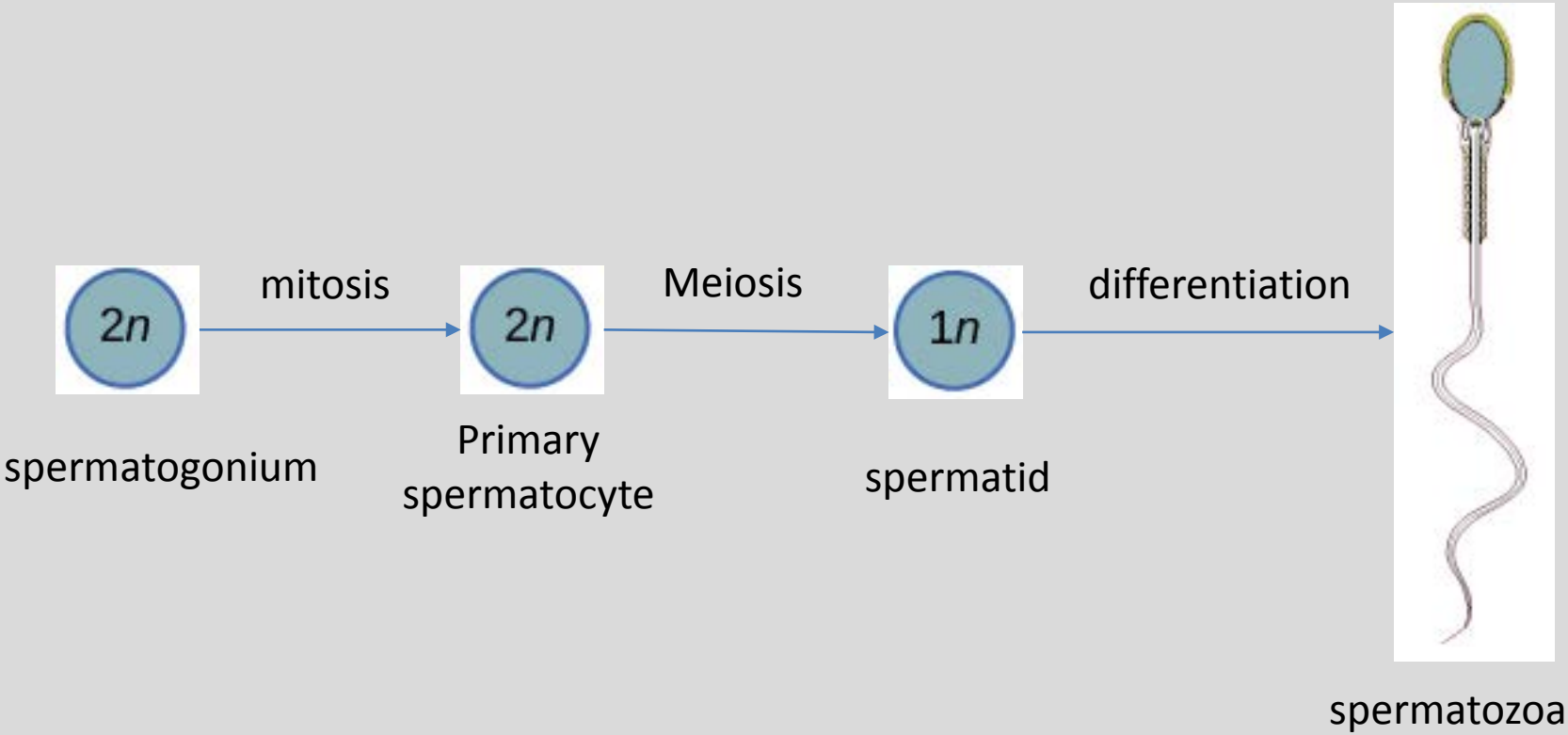
Questions asked

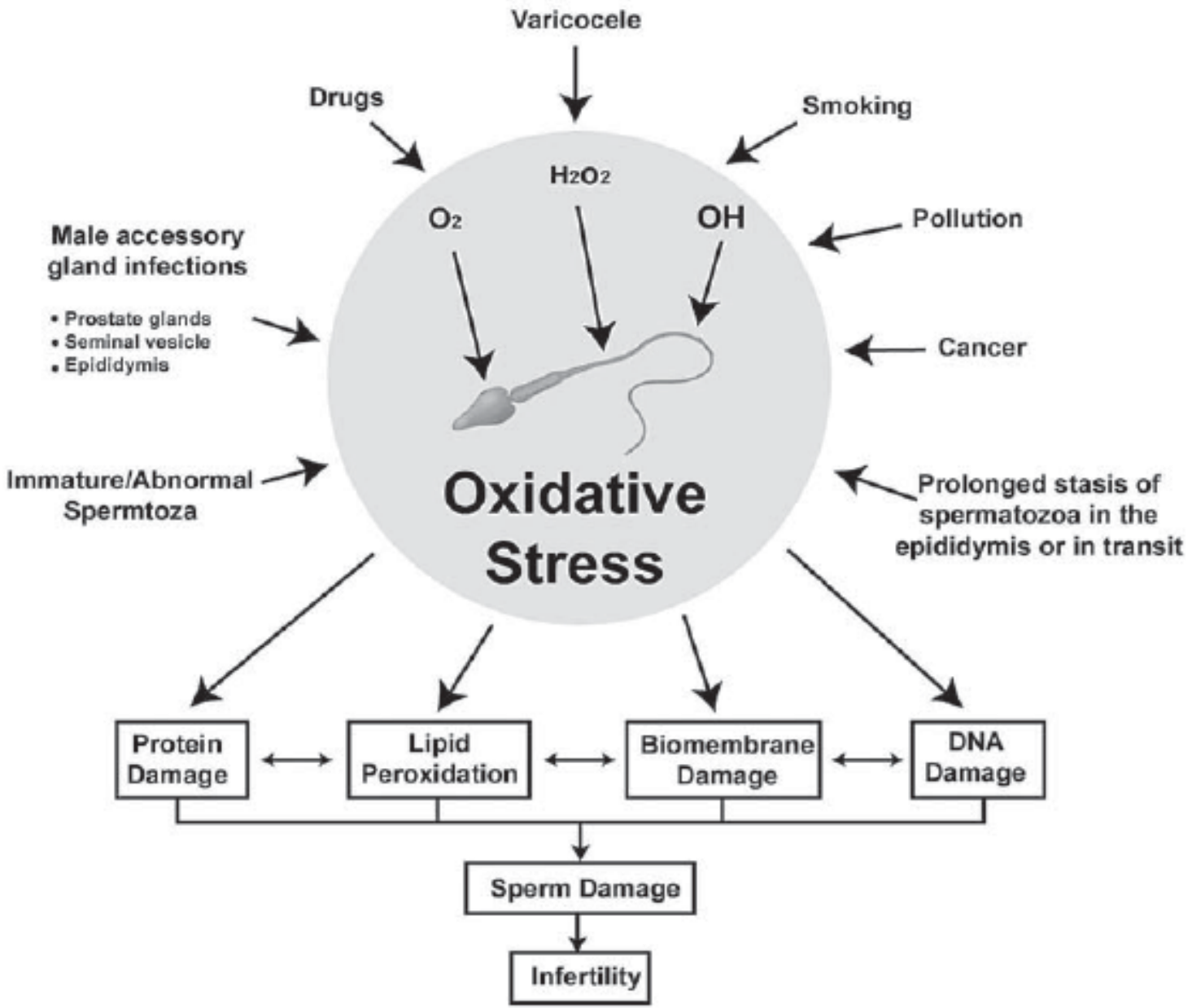
- Can semen analysis be a part of the routine health exam in the working dog?
- Can routine semen analyses be used as a **sole** diagnostic test ?
- Are other semen analysis tests necessary?

Some background

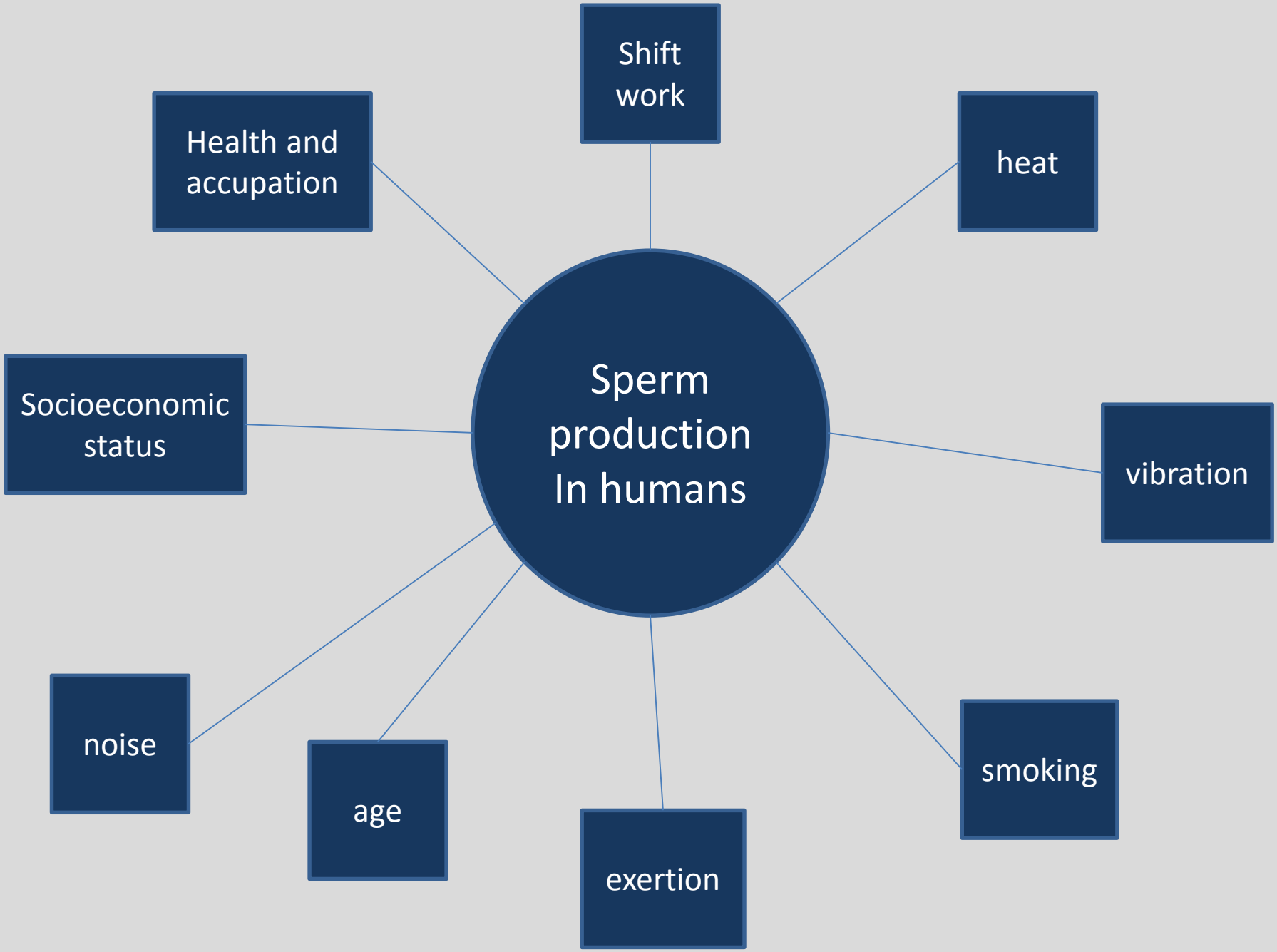
- The relationship between fertility and health is complex (Eisenberg et al, 2014)
- Environmental, hereditary and individual factors (Łepecka-Klusek C. et al 2011)
- Environment conditions affects spermatogenesis (Zou Z. et al,2011; PŠrn T. et al,2015)
- Pollution of air, water, earth, food, drinks, drugs and items in everyday use (Eisenberge et al,2015; Joffe M.,2003; Kumar S.,2004;Schmid TE et al, 2007;Sheiner EK, 2003; Stefankiewicz J et al, 2006; Wdowiak A et al, 2007)

spermatogenesis





Cocuzza M. et al, Int. braz j urol. vol.33 no.5 Rio de Janeiro Sept./Oct. 2007


Shift work
Health and accupation
heat
Sperm production In humans
Socioeconomic status
vibration
noise
age
exertion
smoking

The example of obesity:

- Males with excess body weight due to a surplus of adipose tissue: (Tsao C et alPLoS ONE 10(3) 2015):

➢ reduced sperm numbers

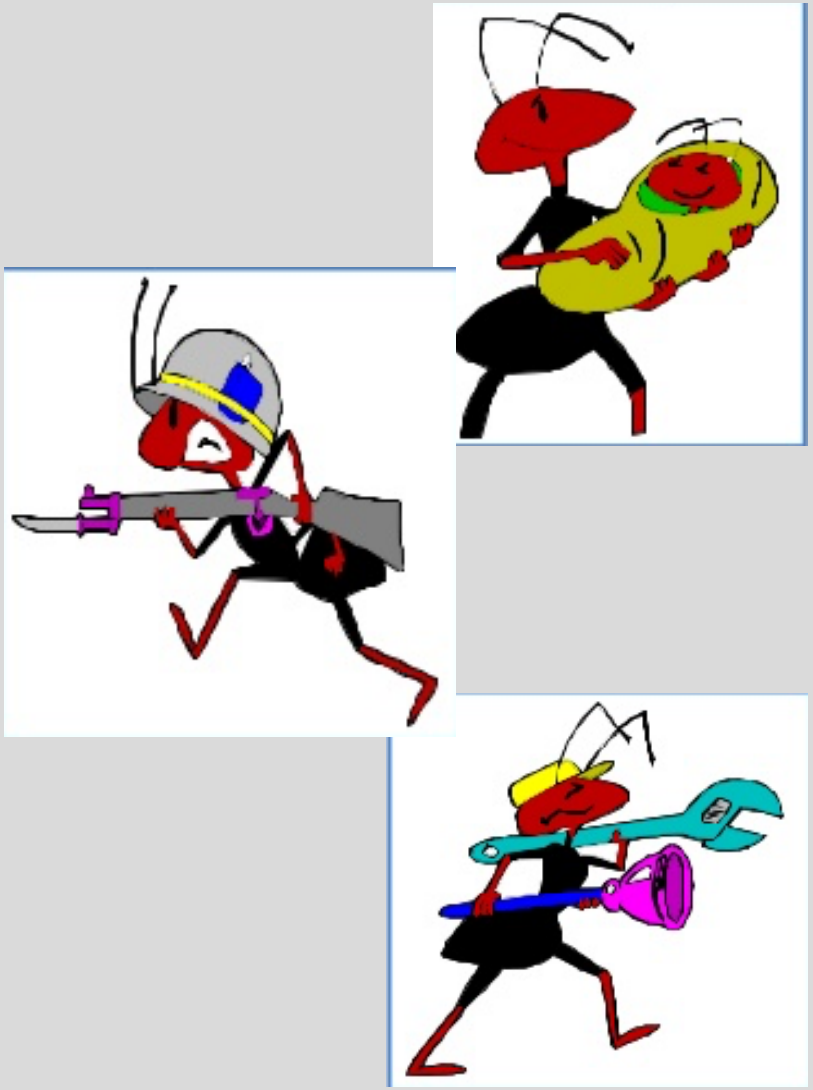
➢ low binding capacity

➢ low fertilization ability

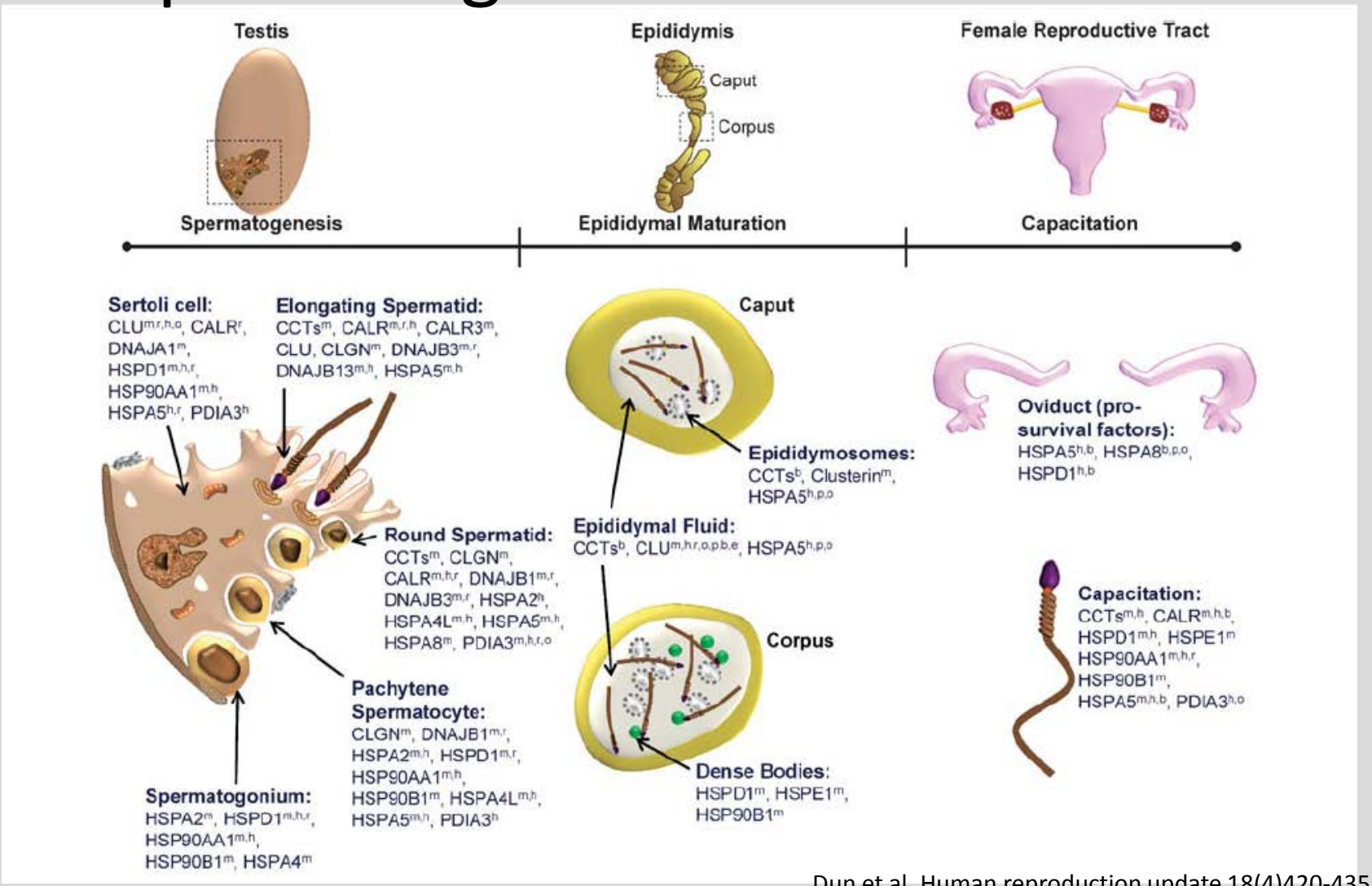
➢ difficulties to undergo capacitation and acrosome reaction

The protectors: Molecular chaperones

- Large family of structurally diverse proteins
- Expressed in all cell types
- Chaperones –**cellular resistance to environmental stressors**
- **Heat Shock Proteins** (HSPs)
- HSP 70 family- best studied



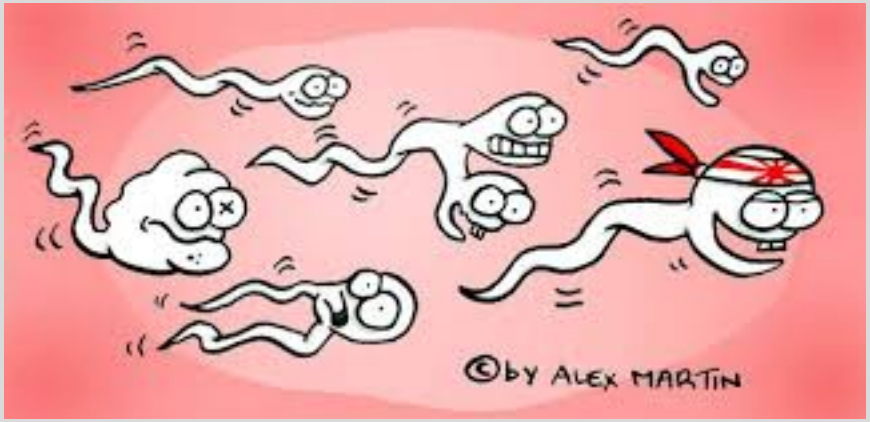
Chaperone expression during spermatogenesis and maturation



Dun et al. Human reproduction update 18(4)420-435,2012

Aberrant expression HSPs

- Arrested spermatogenesis
- Pronounced defects in sperm function



In dogs

- Semen quality and health status – scarce data
- Association between semen quality and canine health- data lacking
- Seminal HSPs and association with health -not been investigated

Study objectives

1. Determine/ Study the use of semen analysis combined with reproductive ultrasonongram as a reliable method to predict working dog health status.

2. Determine whether HSP's are present in the semen, its frequency/level/quantity and its role/association the semen quality and dogs health status

Method- dogs:

- 36 male Malinois MECHELER ☺/Dutch shepherd/crosses

Dog groups:

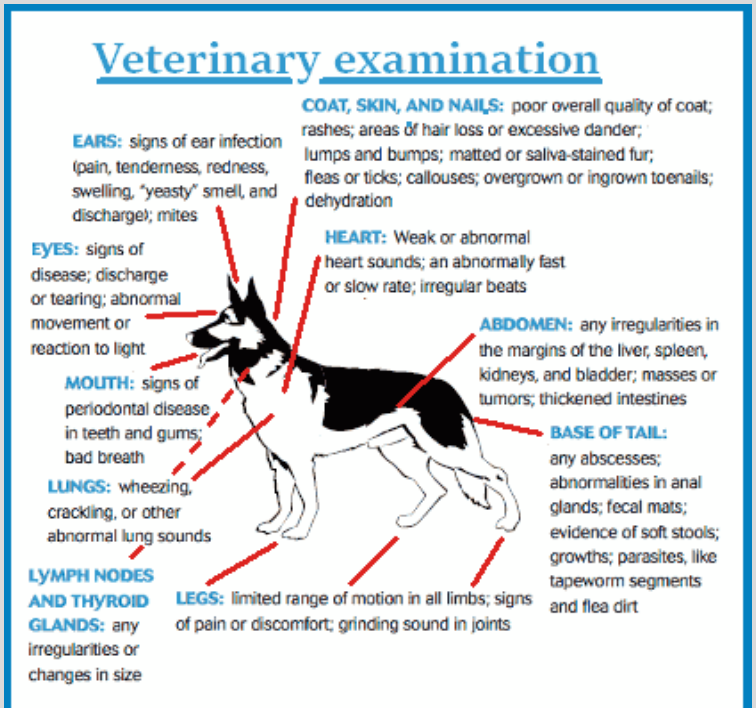
1. Working dogs Group - 15 dogs (1-4 years old), that are currently under a training regime for at least one year.
2. Rested dogs Group - 10 dogs (1-4 years old), that have not worked for at least 90 days; this groups will serve as a control
3. Sick dogs Group - 11 dogs that have experienced illness, suffer from chronic illness, or are ill at the time of examination – of no more than 3 months.

Study design

- Health history was collected
- All dogs underwent:

❖ general physical examination

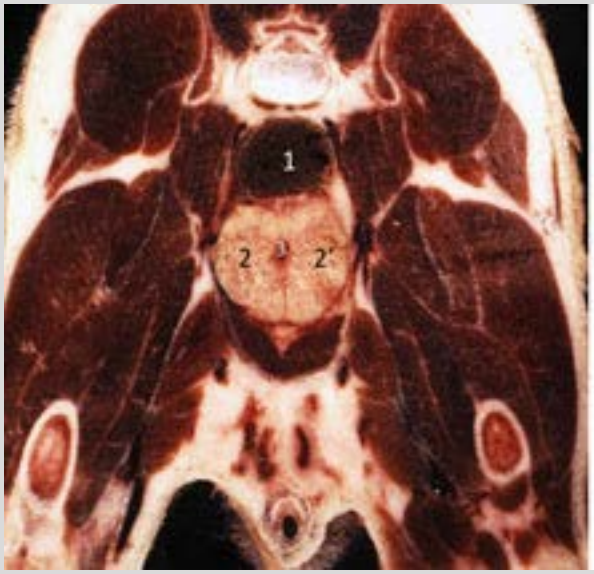
❖ Testicular palpation

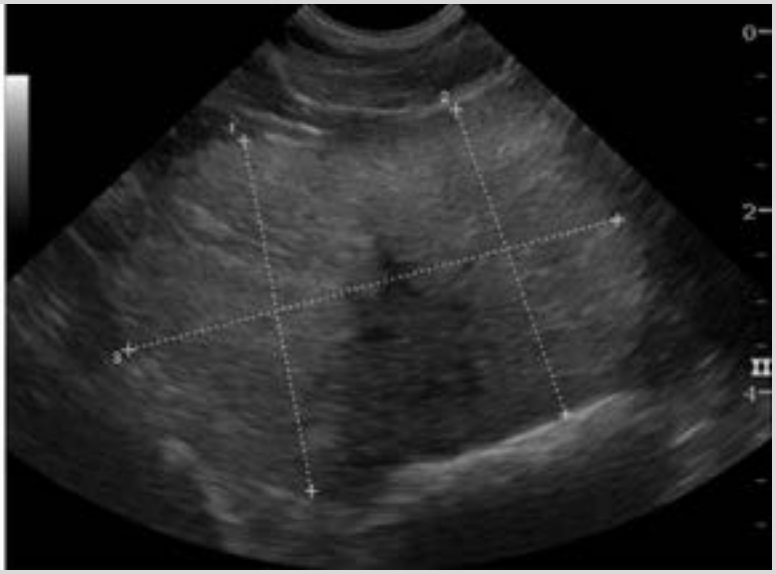


General health parameters:

- Complete blood count
- Blood biochemical analyses
- Urine analysis

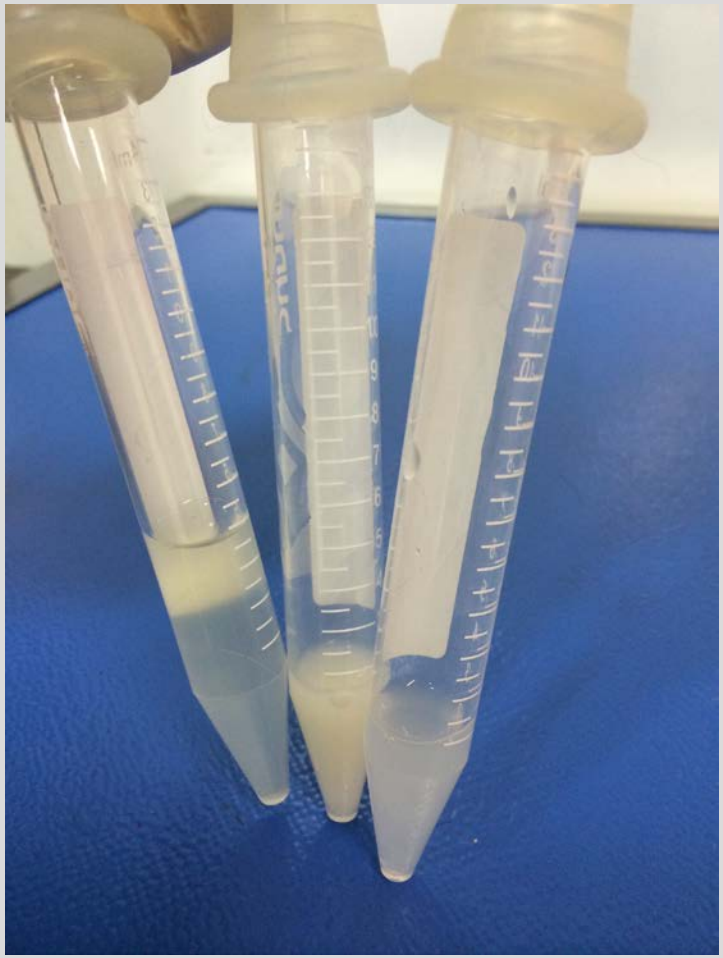
Testicular & Prostatic ultrasonography:





Semen collection

- Semen collected in three fractions:
  - 1ST =presperm fraction
  - 2nd =sperm rich fraction
  - 3rd=prostatic fraction



Semen analysis

- Sperm count
- Motility and progressive motility
- Morphology
- Alkaline phosphatase and PH levels
- cytology

Samples collected from all fractions for future HSPs level analyses.

Normal characteristics of the different fractions of the dog ejaculate:

Characteristics	1st fraction	2nd Fraction	3rd Fraction
Volume	0.1-2 mL (average 0.33 mL)	0.1-3 mL (average 1.17 mL) Sometimes larger volume	1-2 to >20 mL Quite variable depending on the animal.
Colour	clear or opaque	greyish-white, white, milky-white	clear, transparent
Consistency	watery	watery-milky, milky	watery
Character	prostate secretion with admixture of epithelial cells, urine, bacteria and sperm cells	sperm cells suspended in seminal plasma	prostate gland secretion
pH (average)	6.37	6.10	7.20
Duration	5-90 sec. (average 13.5 sec)	5-300 sec. (average 52.4 sec.)	60 sec-20 min. (average 6 min. 55 sec.)

Results

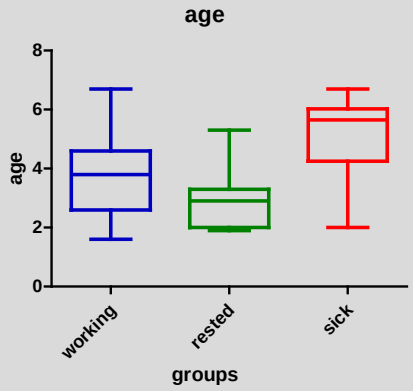
Working dogs in BLUE

Rested dogs in GREEN

Sick dogs in RED

Vital parameters

parameter	Working dogs	Rested dogs	Sick dogs	significant
age	3.9133	2.8736	5	Yes
BCS	3.018	3	2.8	No
Rectal temperature	38.777	38.873	38.867	No
Pulse rate	91.692	98.545	107.111	no

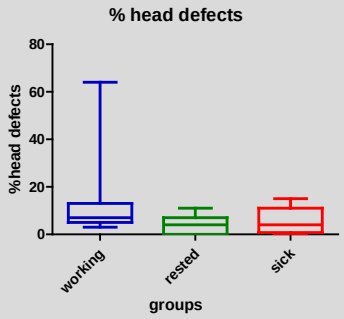


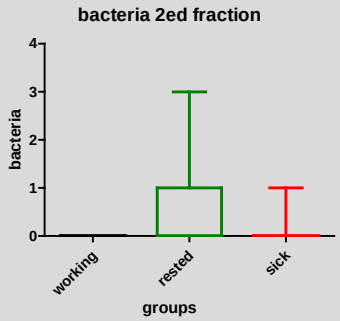
Semen parameters

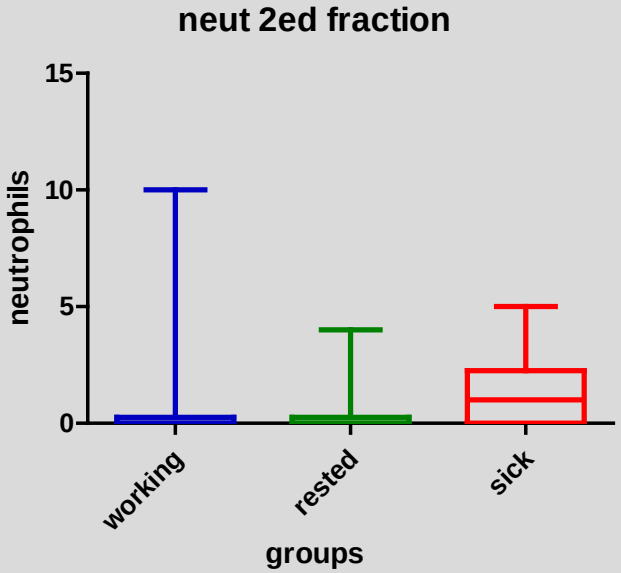
parameter	Working dogs	Rested dogs	Sick dogs	significant
Fraction 1Volume	2.25	2.36	1.62	no
Fraction 2 Volume	1.2	1.25	1.05	no
Fraction 3 PH	7.333	7.636	7.76	no
Total Semen conc.	233.82	311.045	369.75	no
Neuts 3rd fraction	0.733	0	0.2	no
motility	69.643	79	69	no
% normal sperm	63	72.455	56	no
ALP 2nd fraction	22349	58161	57530	no
% midpiece defects	15.933	10.909	22.2	no

Semen parameters

parameter	Working dogs	Rested dogs	Sick dogs	significant
% tail defects	7.733	3.545	6.3	
Neuts 2nd fraction	0.857	0.5	1.4	yes
Head defects	13.33	4	5.6	tendency
Bacti 2nd fraction	0	0.455	0.1	tendency



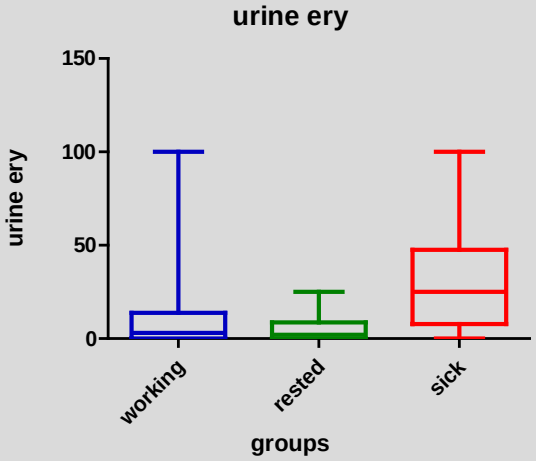


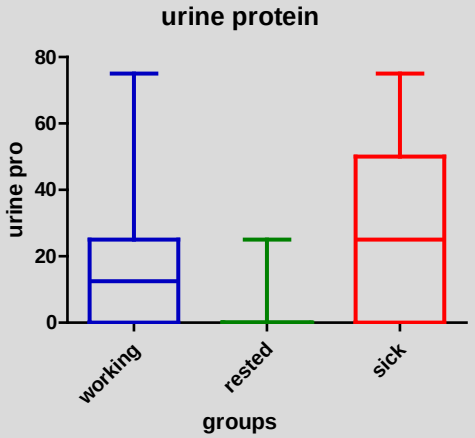


Urine parameters

parameter	Working dogs	Rested dogs	Sick dogs	significant
Urine PH	7.071	7.313	7.056	no
Urine WBC	13.143	9.375	20.444	
Urine Proteins	16.07	3.13	27.78	tendency
Urine glucose	0.07	0	0	no
Urine nitrites	0.14	0	0.11	no
Urine ketones	2.14	1.25	3.33	no
Urine epithelial cells	0.571	0.313	0.111	no
Urine sperm	1.29	1.50	1.11	no
Urine RBC	13.192	5.438	30.611	tendency

Graphs – relevant urine parameters

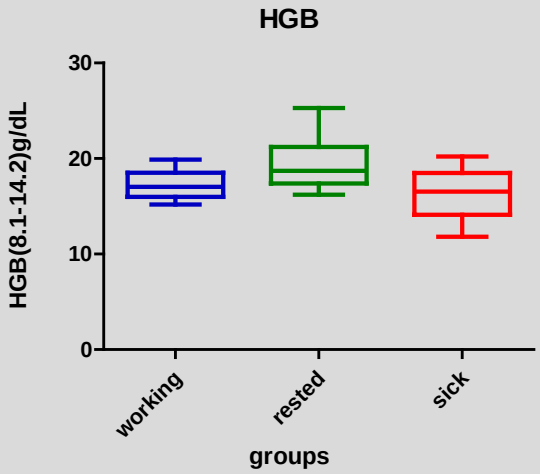


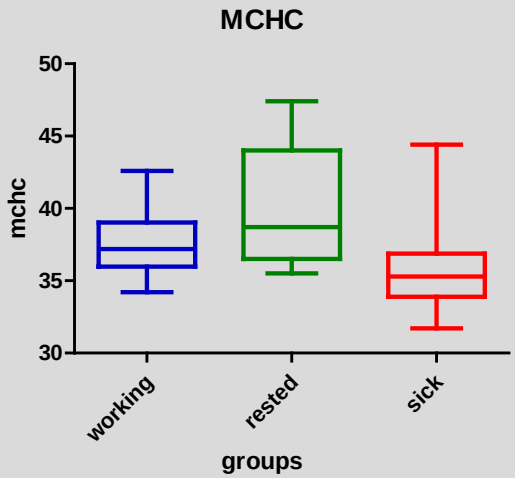


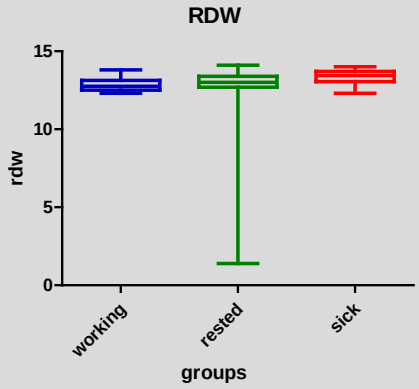
Complete blood count parameters:

parameter	Working dogs	Rested dogs	Sick dogs	significant
WBC	9.2771	8.7364	10.624	no
RBC	6.98	7.55	6.91	no
HGB	17.2	19.46	16.38	yes
MCHC	37.6	39.9	35.9	yes
RDW	12.814	12.027	13.34	yes
platelets	192.93	189	273.6	no
%neutrophils	48.257	45.209	37.11	no
% lymph	38	38.655	46.48	no
PCV	46.5	49.18	46.10	no

Graphs – blood parameters





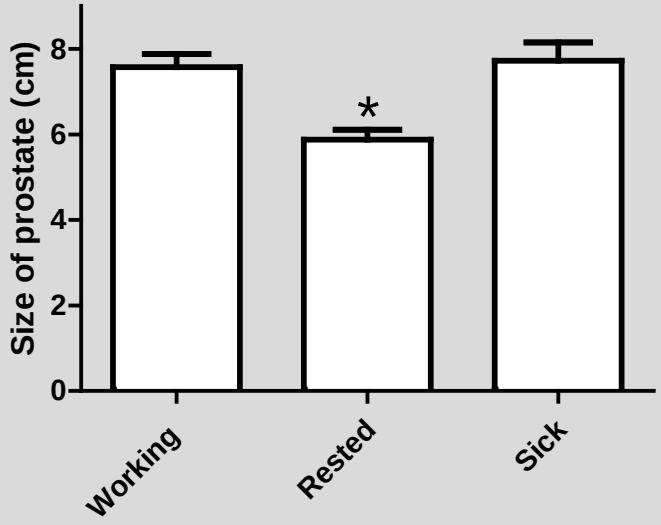


Blood biochemistry

parameter	Working dogs	Rested dogs	Sick dogs	significant
Albumin	3.9	3.92	3.7	no
ALP	43.27	39.27	46.3	no
Calcium	0.078	0.92	0.648	no
Cholesterol	185.38	174.373	187.44	no
Glucose	96.14	92.7	92.04	no
Phosphate	3.7947	3.6655	3.888	no
Trigl	33.553	31.591	40.01	no
Urea	53.567	49.091	3.230	no
Na	44.867	145	146.2	no

Prostate lobe diameter size

- The Size of the right and left prostate of Group 2 was significantly lower (P≤0.0014) then groups 1 and 3



So- to conclude:

- Several parameters show differences
- Few semen parameters show association or tendency for differences
- HSPs results in processing- awating results
- This data may be used in the future for standardization of a tool for health status evaluation in dogs

Future research

- Expand to larger numbers
- Use in different breeds
- Use in different types of working dogs
- Histones, cytokines, interleukines in seminal fluid

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Questions?