



PIG AS A MODEL FOR NUTRIGENOMIC STUDIES

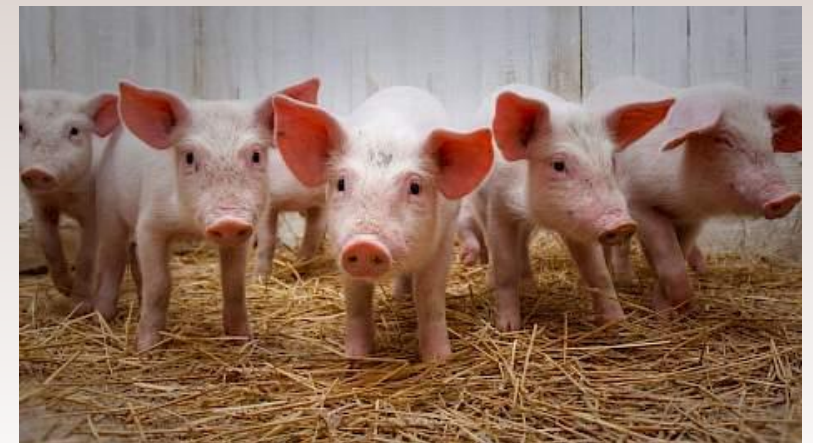
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NATIONAL RESERACH INSTITUTE OF ANIMAL PRODUCTION

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CORE ACTIVITY OF THE INSTITUTE

- CONDUCTING RESEARCH (BASIC, APPLIED, INDUSTRIAL), DEVELOPMENT WORK IN ANIMAL PRODUCTION AND MANAGEMENT OF AGRICULTURAL LANDSCAPE
- APPLYING RESEARCH FINDINGS TO PRACTICE

DEPARTMENT OF ANIMAL MOLECULAR BIOLOGY

- INDIVIDUAL IDENTIFICATION AND PARENTAGE TESTING,
- GENOTYPING FOR BREEDING USING 60K ILLUMINA MICROARRAY
- POLYMORPHISM OF B-CASEIN GENE IN CATTLE,
- ANIMAL FORENSIC GENETICS,
- SCRAPIE GENOTYPING IN SHEEP,
- SPECIES IDENTIFICATION OF ANIMAL COMPONENTS,
- KARYOTYPE ANALYSIS,
- SEX IDENTIFICATION OF PARROTS AND OTHER BIRDS,
- DETECTION OF HONEY IN FOOD PRODUCTS.





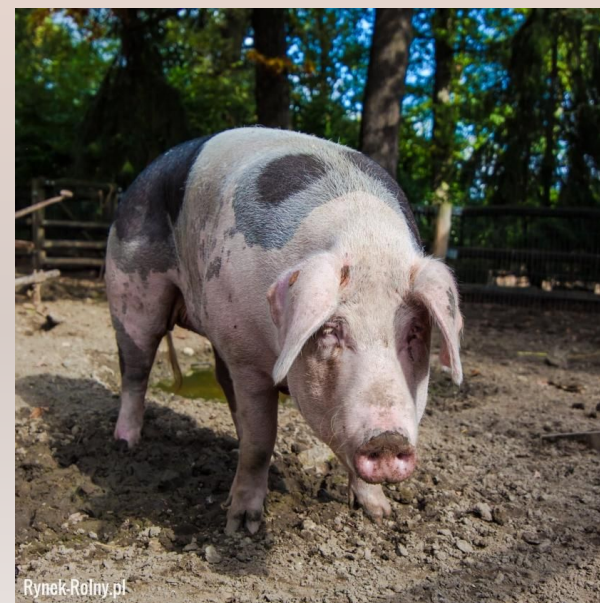
POLISH FATTY PIGS



Puławska breed

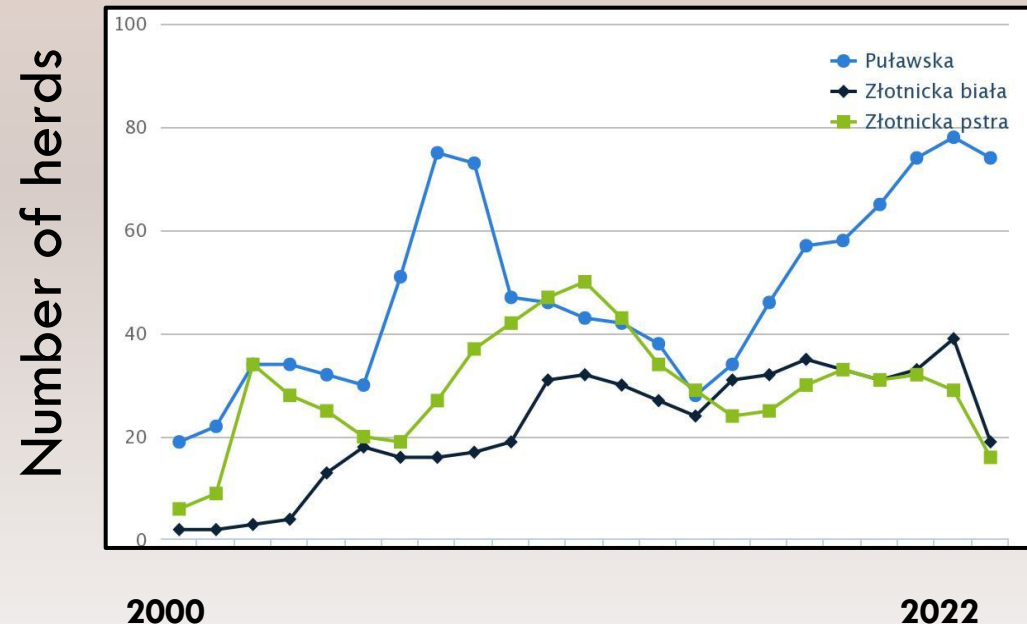
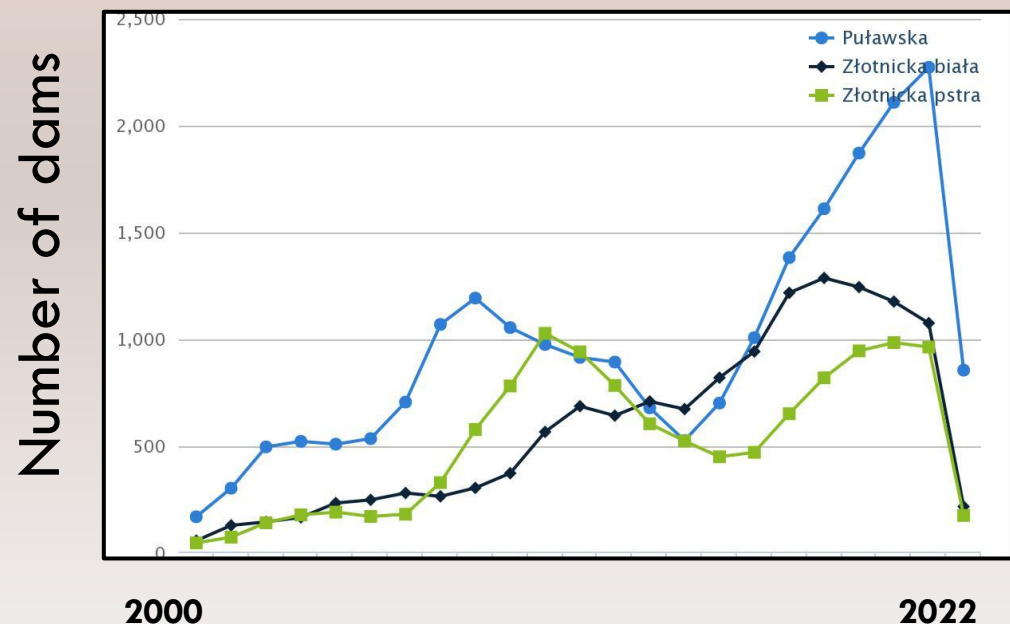


Złotnicka white



Złotnicka spotted

GENETIC RESOURCES PROTECTION PROGRAM FOR PUŁAWSKA, ZŁOTNICKA WHITE AND ZŁOTNICKA SPOTTED PIGS



NUTRIGENOMICS

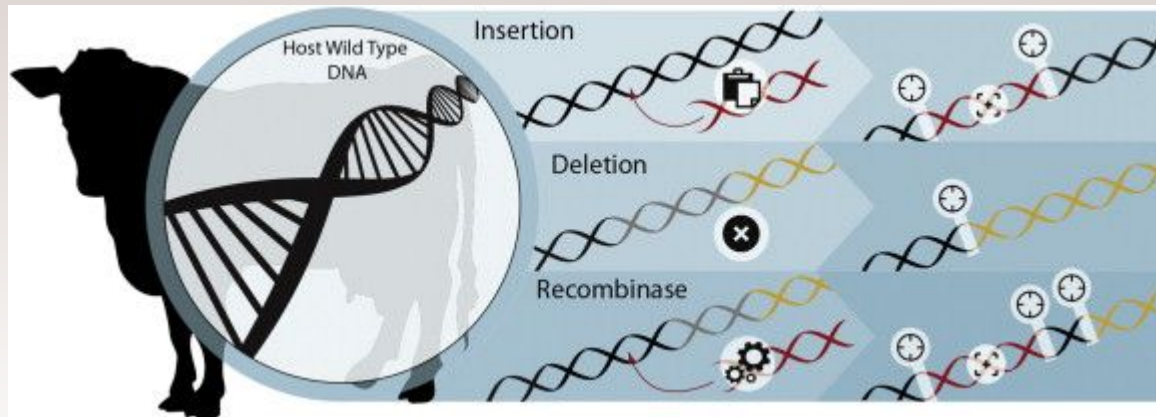
- A BRANCH OF SCIENCE DEALING WITH THE STUDY OF THE INFLUENCE OF FOOD INGREDIENTS ON THE REGULATION OF GENE EXPRESSION.
- NUTRIGENOMICS IS AN INTERDISCIPLINARY SCIENCE THAT ENCOMPASSES GENETICS, MOLECULAR NUTRITION, MOLECULAR BIOLOGY, PHARMACOGENOMICS, MOLECULAR MEDICINE, AND BIOINFORMATICS.



NUTRIGENETICS



- Nutrigenetics, in turn, deals with the genetic differences between people, which translate into the fact that each of us reacts differently to the same dietary components.
- Genodiet, personalized nutrition



EFFECT OF FEEDING PIGS WITH VARIOUS TYPES OF FAT ON CHANGES IN GENE EXPRESSION IN THE LIVER.

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FATTY ACIDS COMPOSITION OF DIET

- ONE OF THE MOST IMPORTANT FACTORS INFLUENCING THE INCIDENCE OF CIVILIZATION DISEASES
- POTENTIAL MOLECULAR MECHANISM: OXIDATIVE STRESS, INFLAMMATION, MITOCHONDRIAL DYSFUNCTION, AUTOPHAGY AND PROTEOSTASIS DISORDERS, LIPOTOXICITY
- FATTY ACIDS - IMPORTANT SIGNAL MOLECULES

C18:3 A LINOLENIC ACID ALA



cardiovascular-protective

antioxidative

anti-cancer

neuro-protective

anti-osteoporotic

anti-inflammatory

Reduces the risk of diabetes T2D

Decreases body weight

C16:0 PALMITIC ACID



increases beta amyloid
genesis

proinflammatory

cancerogenous

Increases the risk of
cardiovascular disease

Increases insulin-resistance

Changes gut microbiome

MCFA : MYRISTIC C14:0, LAURIC C12:0, CAPRIC C10:0,
CAPRYLIC C8:0



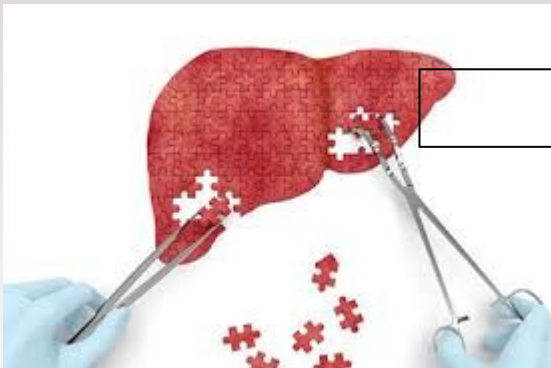
antibacterial

risk of cardiovascular disease ?

Alzheimer's disease?

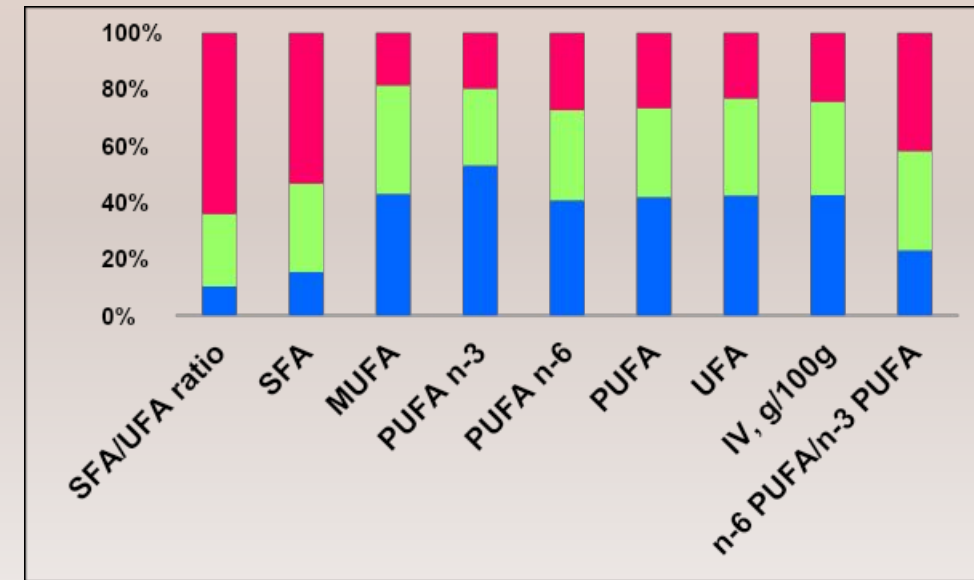
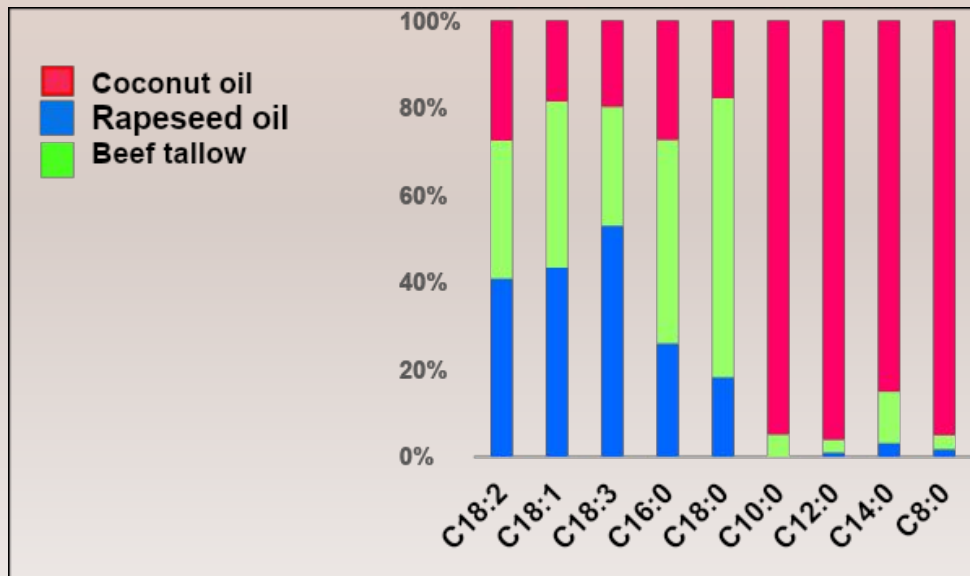
Cancerogenous
(colorectal cancer)?

Group I - rapeseed oil Group II - beef tallow Group III - coconut oil

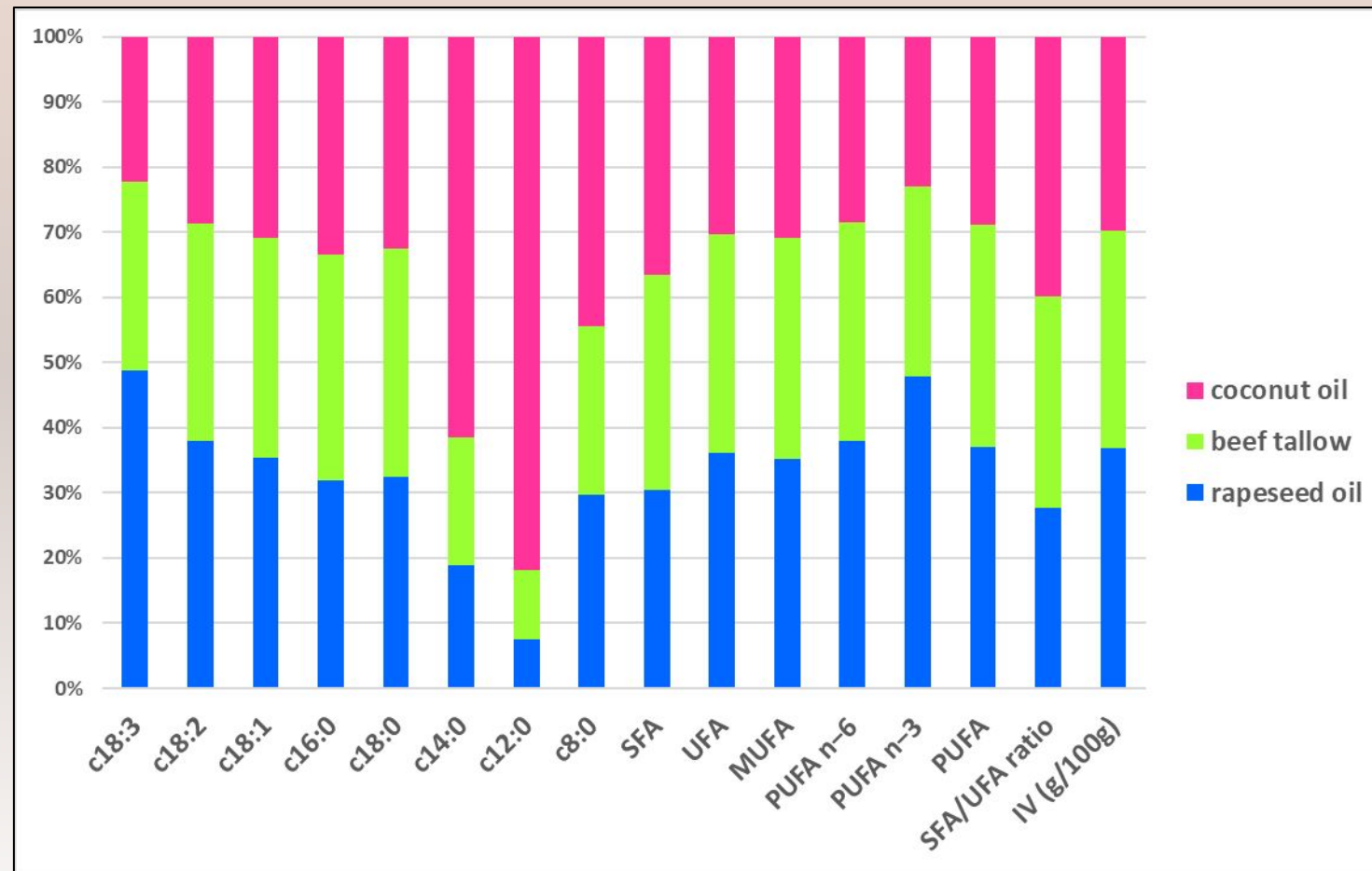


Liver samples were collected from the animals for gene expression analysis

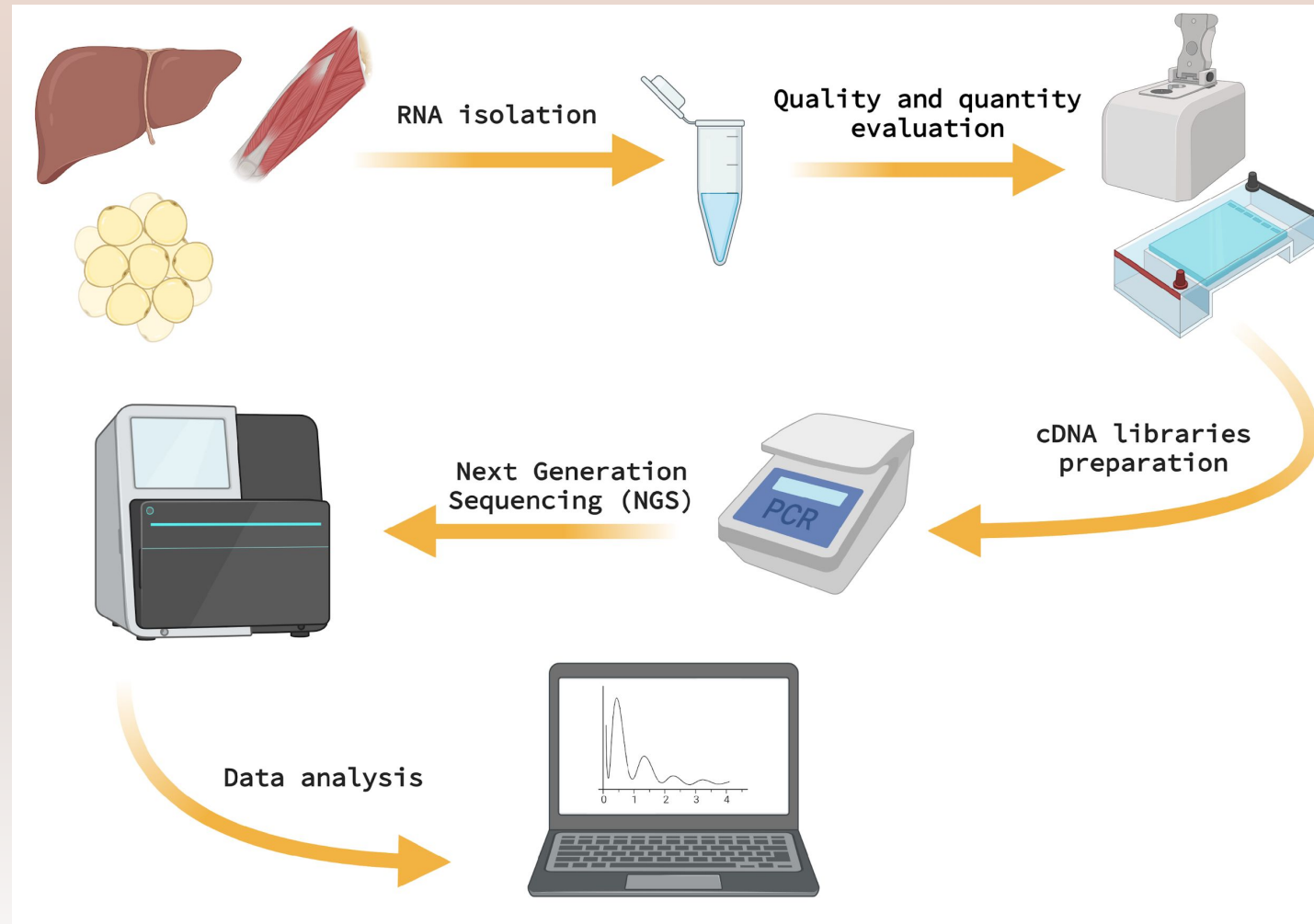
Composition of fatty acids in the feeds used in the experiment.



Fatty acid composition of pig back fat receiving different types of fat in the diet



Materials and Methods



RESULTS



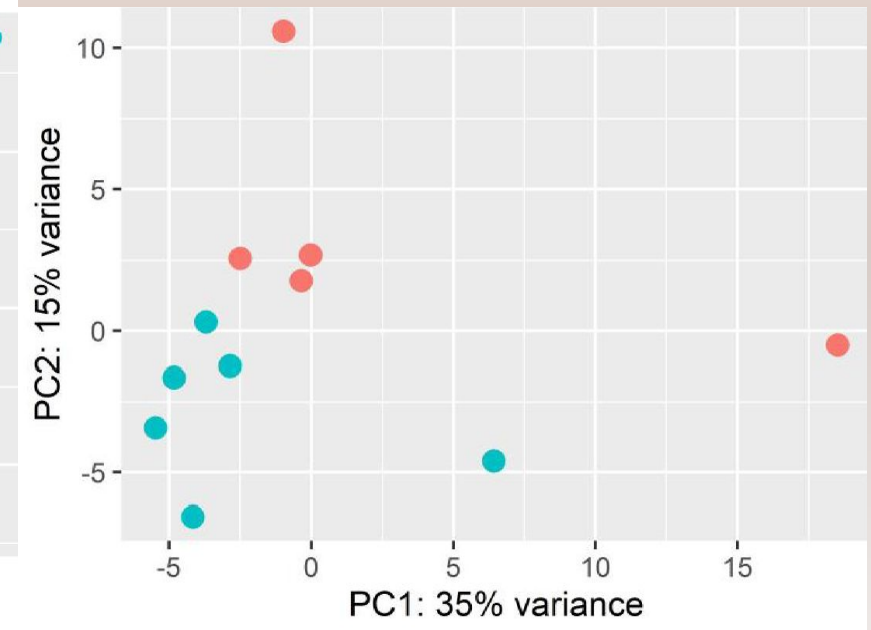
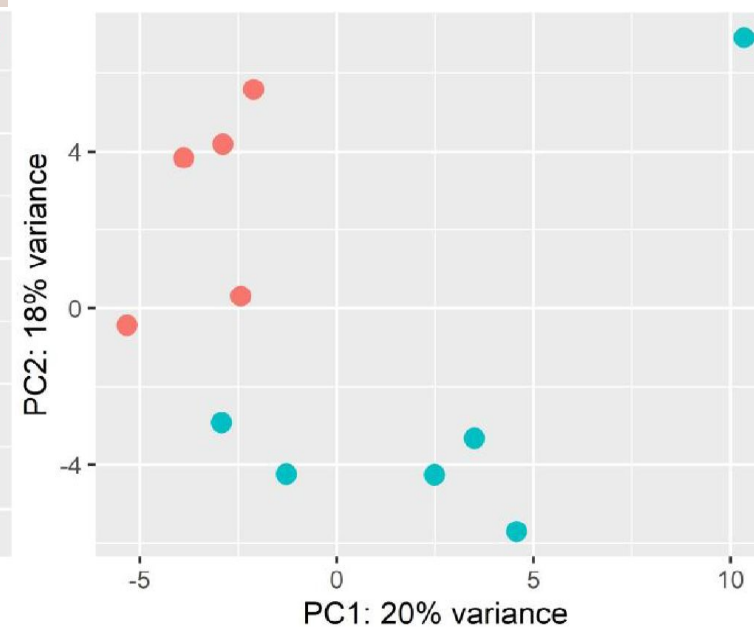
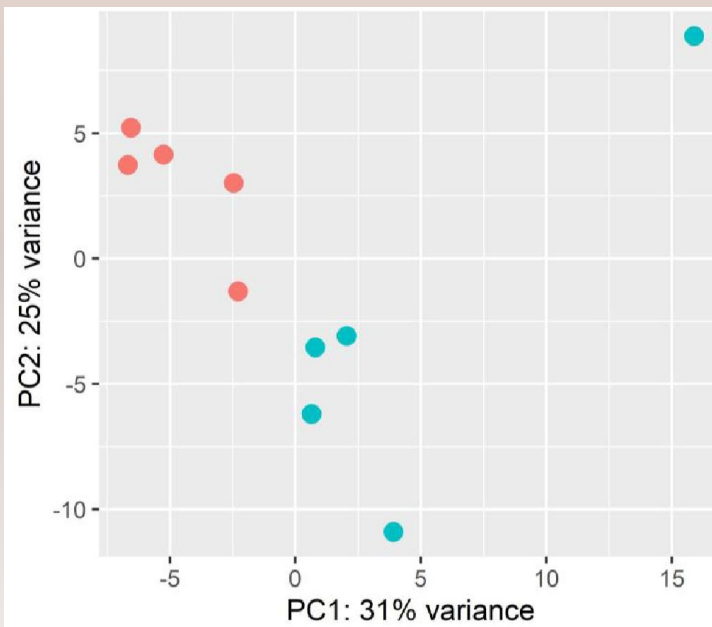
VS



VS



VS



RESULTS

GROUP I _{vs} GROUP II



VS



188 DEGs

GROUP I _{vs} GROUP III



VS



93 DEGs

GROUP II _{vs} GROUP III

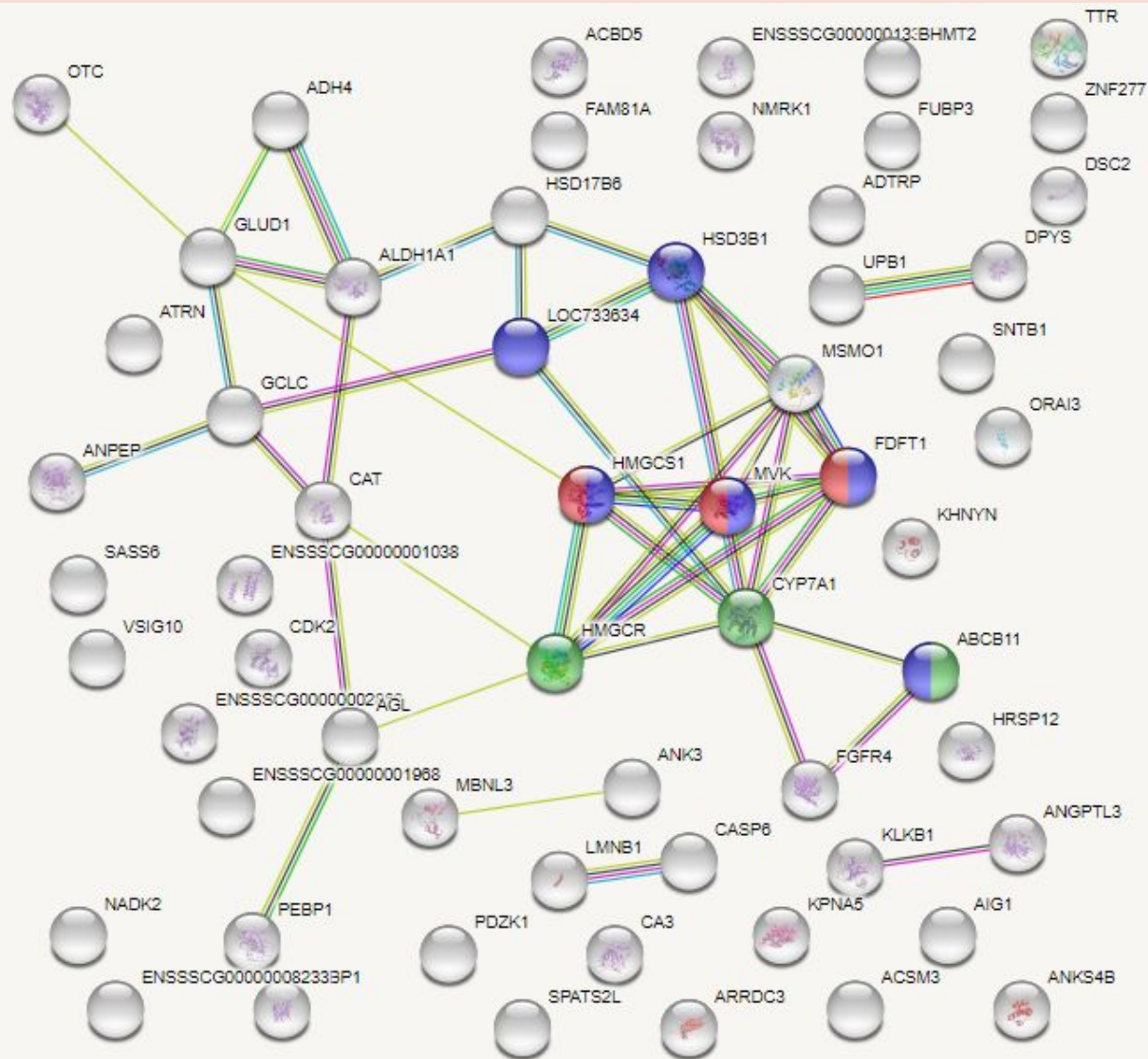


VS



53 DEGs

DEGs – Differentially Expressed Genes



STRING



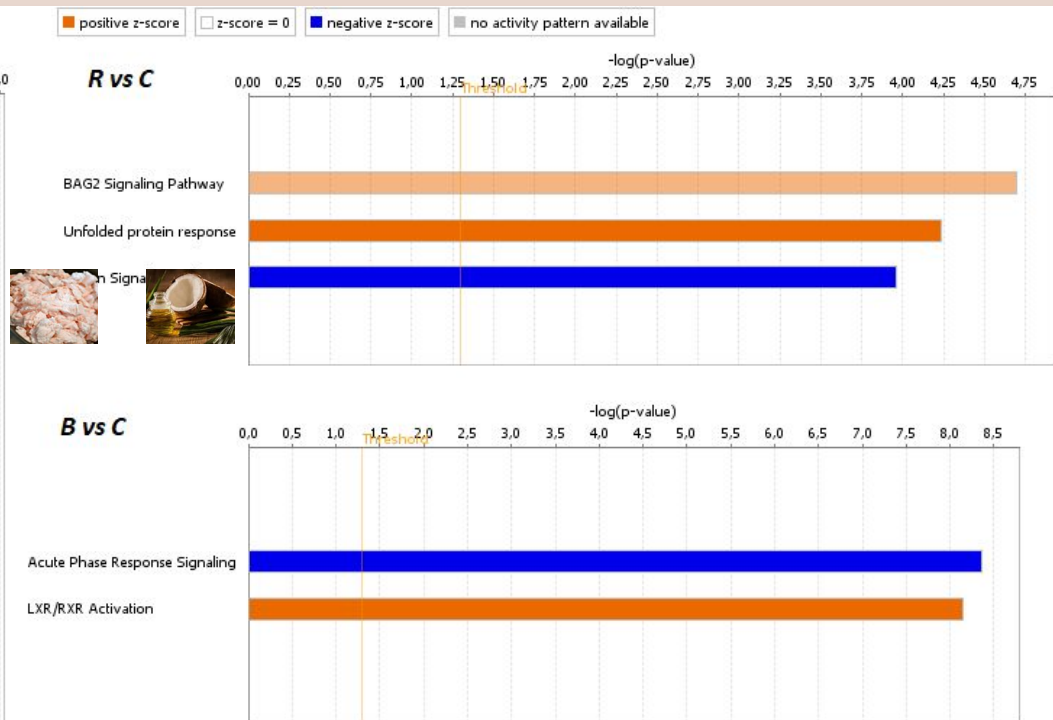
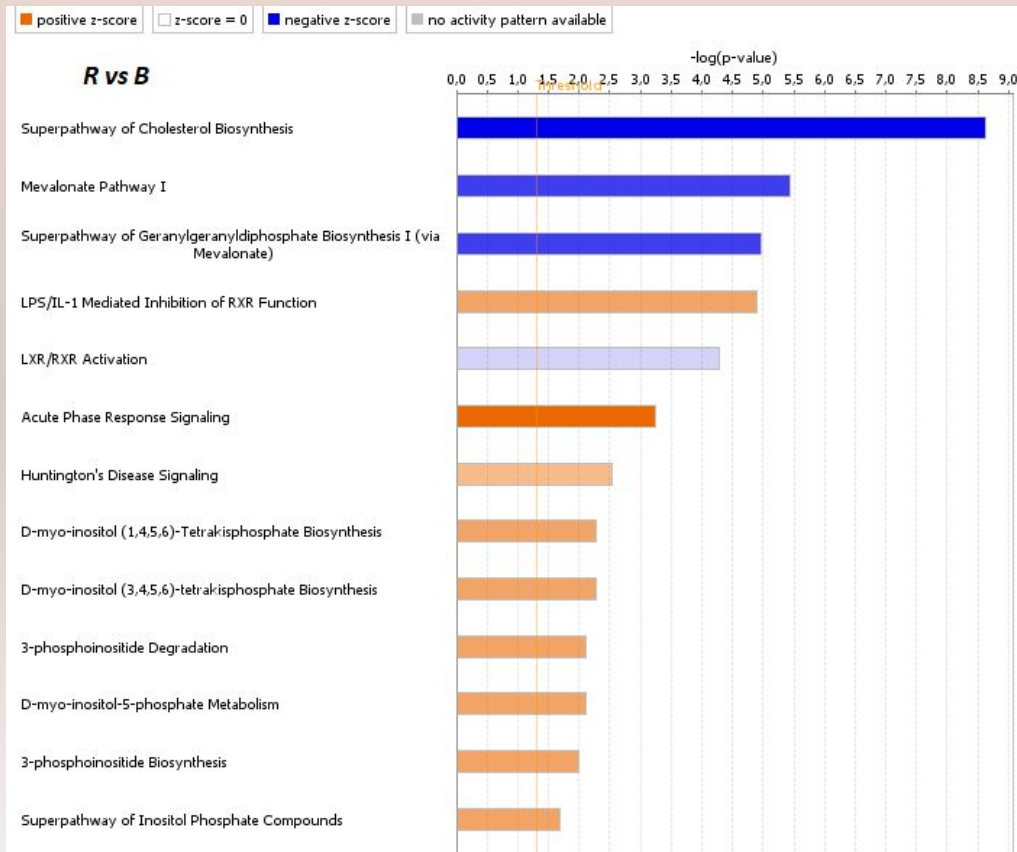
VS



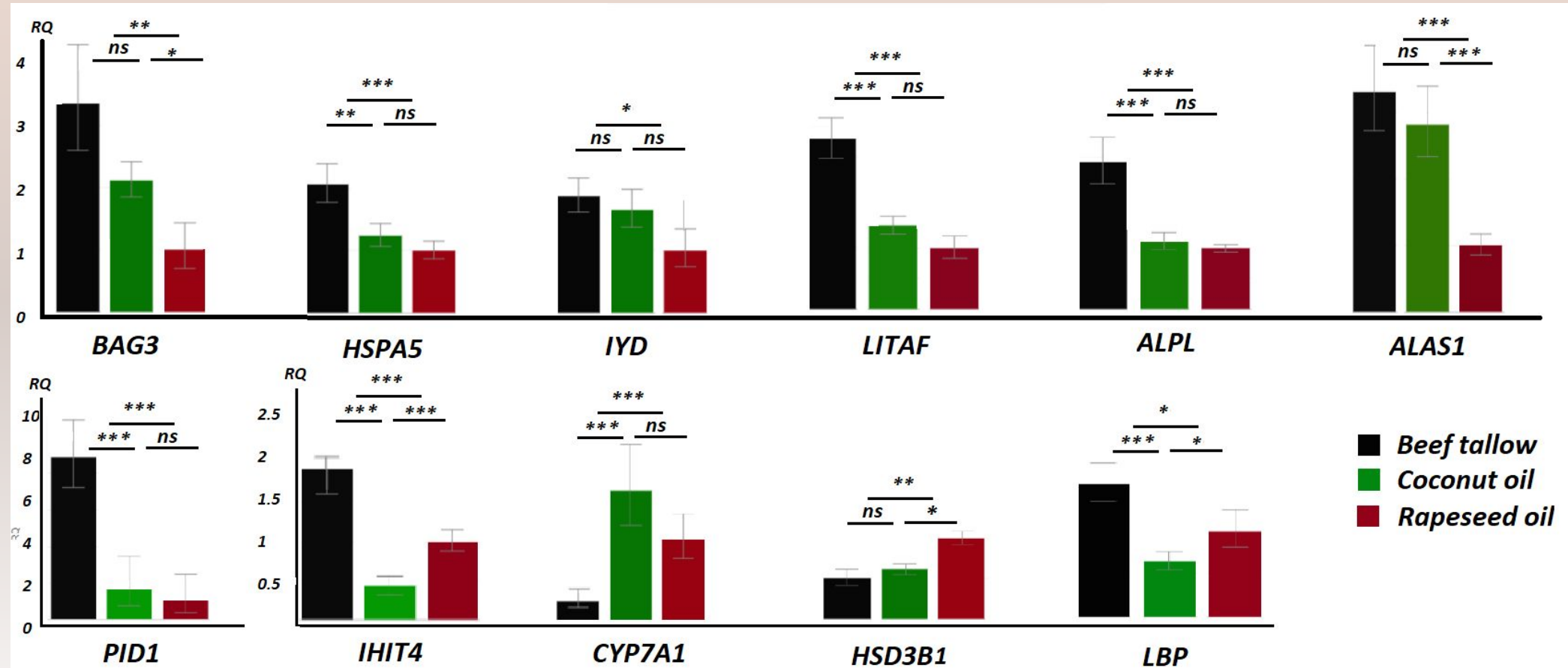
Cholesterol biosynthesis **FDR<0.002**

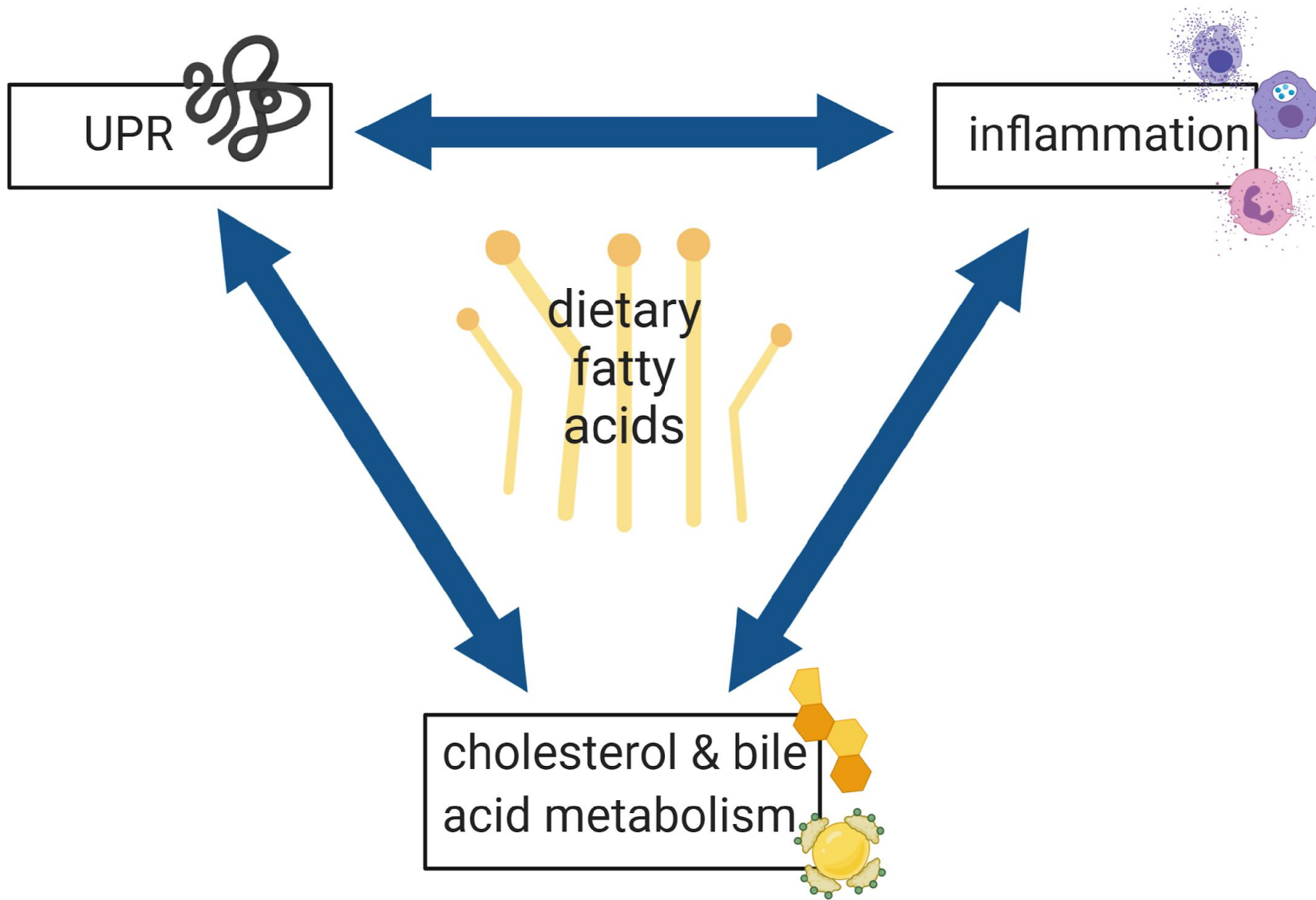
Metabolism of steroids **FDR<1.84E-05**

Bile acid secretion **FDR<0.008**



qPCR validation – relative mRNA expression





EFFECT OF VITAMIN D3 SUPPLEMENTATION OF PIGS DIET ON TRANSCRIPTOME AND PROTEOME IN SELECTED TISSUES.

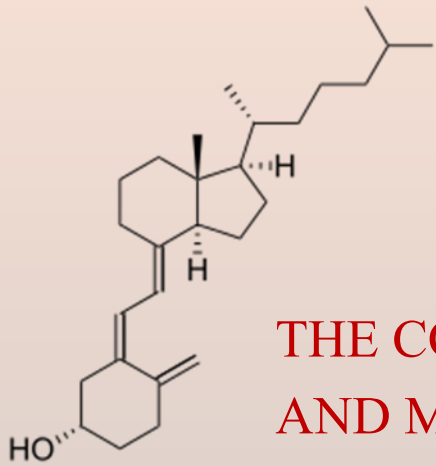
PH.D. STUDENT: M. SC. ANNA STEG

PROMOTER: PROF. MARIA OCZKOWICZ

AUXILIARY PROMOTER: PH.D. GRZEGORZ SMÓLUCHA

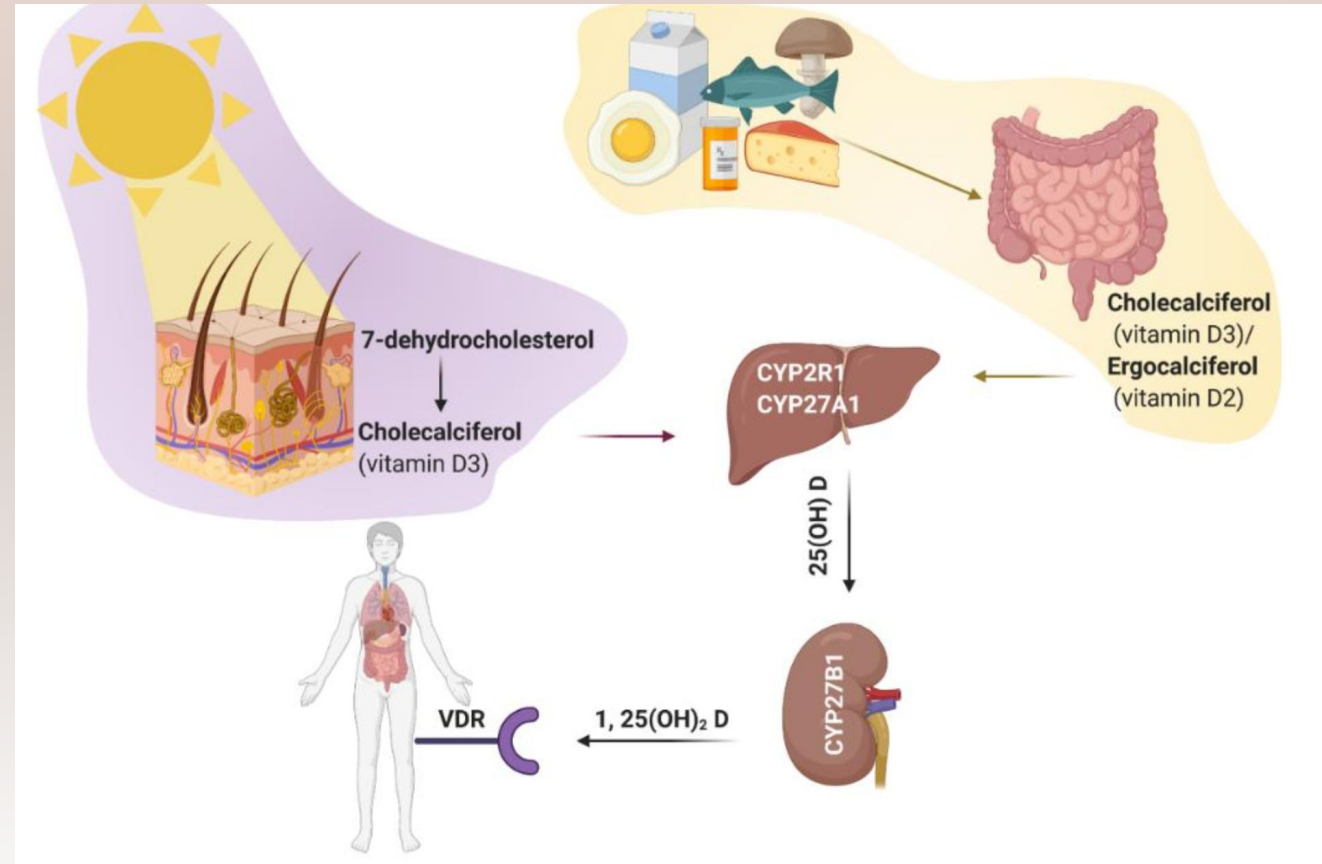
National Research Institute of Animal
Production

Department of Animal Molecular Biology



THE CONNECTION BETWEEN VITAMIN D3 AND MEDICAL CONDITIONS

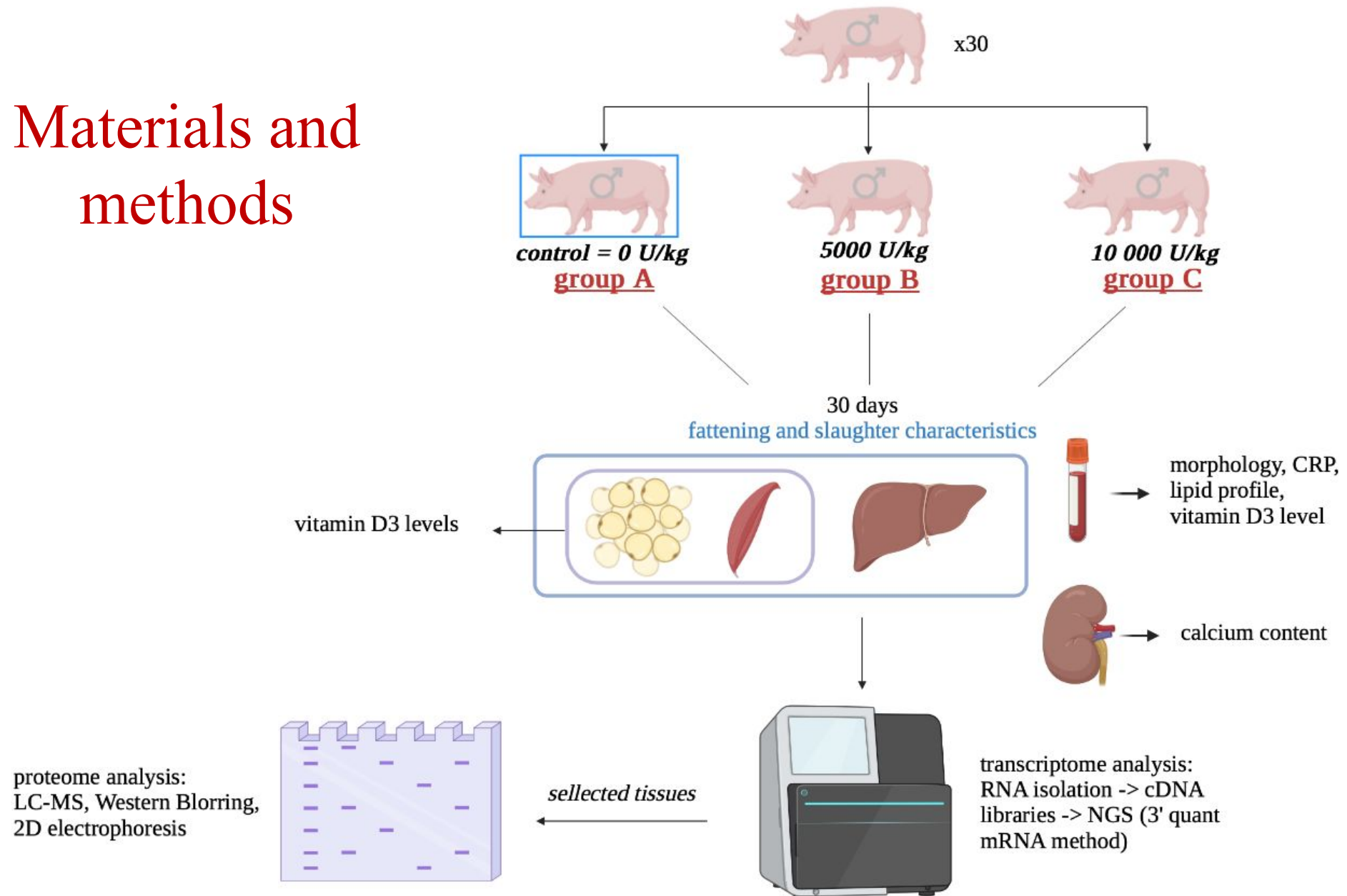
- OBESITY
- TYPE II DIABETES
- DEPRESSION
- CANCER
- MYOPATHY
- CARDIOVASCULAR DISEASES
- DECREASED IMMUNITY +
- RICKETS, OSTEOPOROSIS +



STUDY GOALS:

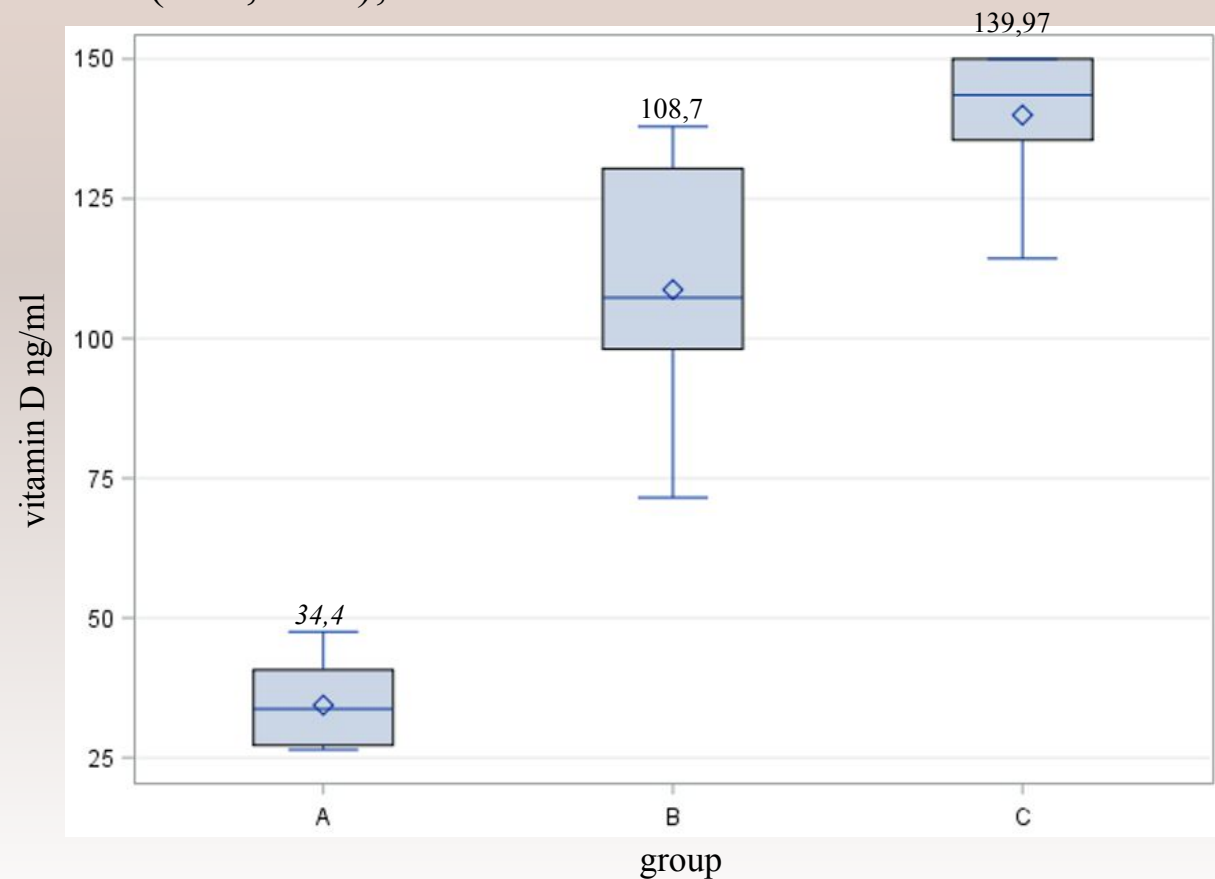
- DETERMINING THE IMPACT OF VITAMIN D3 SUPPLEMENTATION ON BIOLOGICAL PROCESSES OCCURRING IN PIG TISSUES;
- ASSESSING THE SUITABILITY OF USING THE DOMESTIC PIG AS A MODEL FOR PROCESSES OCCURRING IN HUMANS UNDER THE INFLUENCE OF VITAMIN D3;
- ANALYSIS OF THE IMPORTANCE OF VITAMIN D3 SUPPLEMENTATION IN HUMANS AND ANIMALS;
- DETERMINATION OF THE OPTIMAL DOSE;
- CHECKING THE POSSIBILITY OF OBTAINING PORK PRODUCTS ENRICHED WITH VITAMIN D (MEAT AND FAT) BY SUPPLEMENTING THE ANIMAL DIET WITH THIS VITAMIN.

Materials and methods



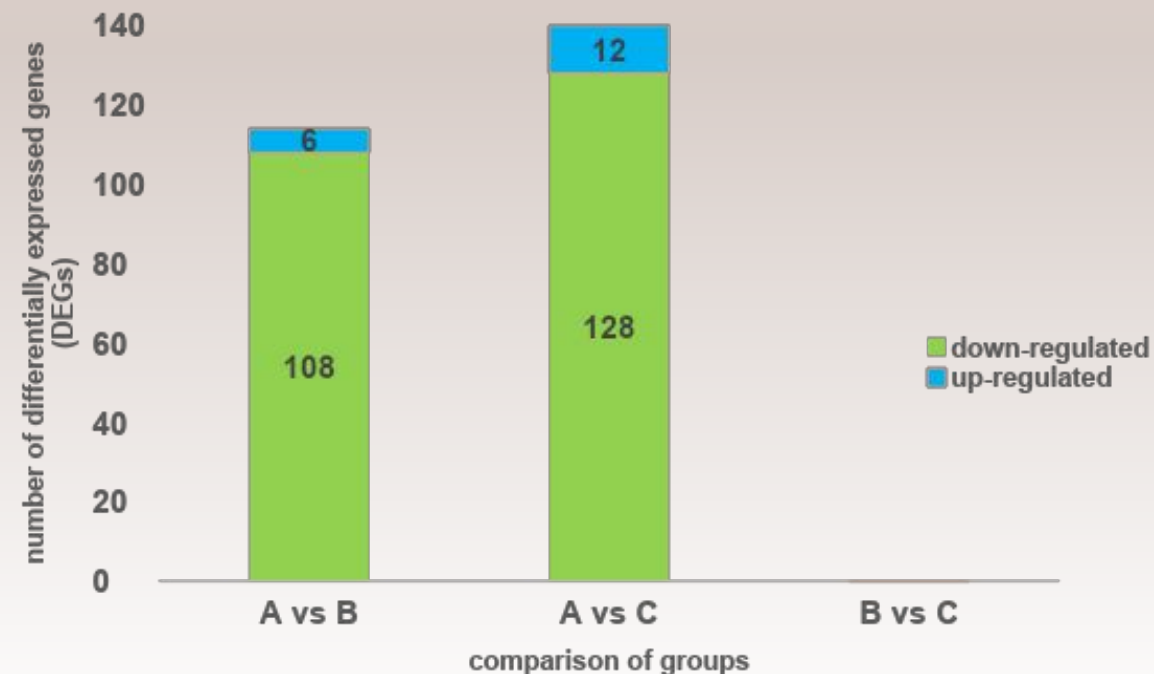
RESULTS

- SUPPLEMENTATION WITH 5000 U/KG OF FEED RESULTED IN AN OVER 3-FOLD INCREASE, AND SUPPLEMENTATION WITH 10000 U/KG OF FEED RESULTED IN A 4-FOLD INCREASE IN VITAMIN D3 STATUS IN BLOOD ($P < 0,0001$);



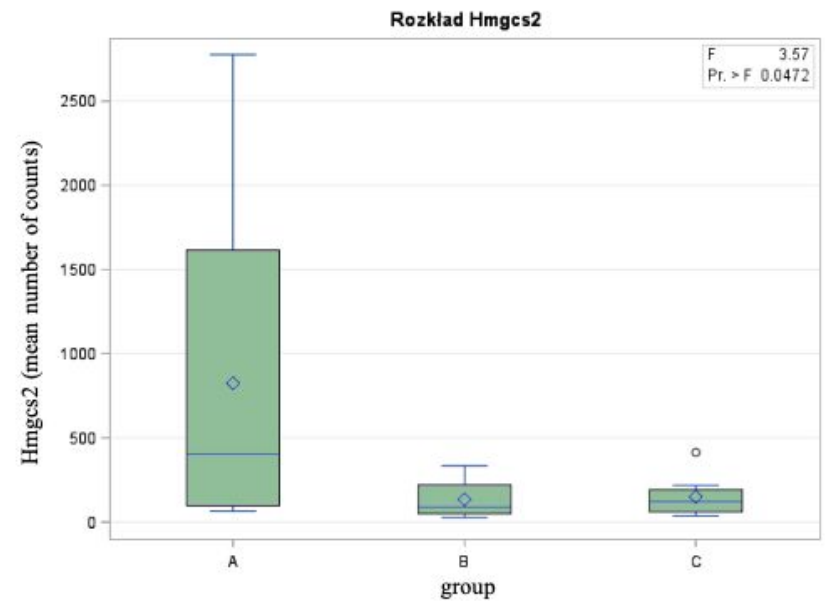
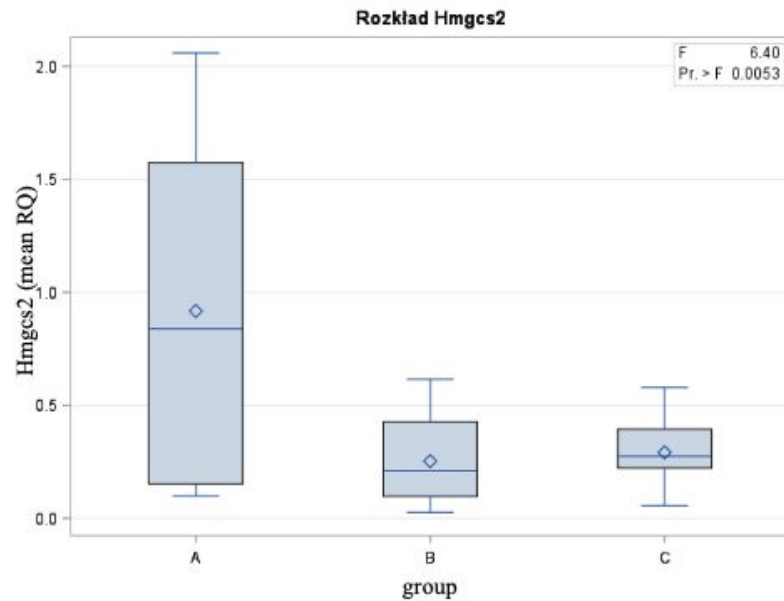
- SUPPLEMENTATION WITH HIGH DOSES OF VITAMIN D3 CAUSES CHANGES IN THE EXPRESSION OF 115 GENES IN THE CASE OF THE DOSE OF 5000 U / KG OF FEED, AND 140 GENES IN THE CASE OF THE DOSE OF 10000 U / KG OF FEED IN THE LIVERS;

	expressed genes	diff. expr. %	diff. exp. genes	up regulated	down regulated
A vs B	16551	0,69	114	6	108
A vs C	16549	0,85	140	12	128
B vs C	16657	0	0	0	0



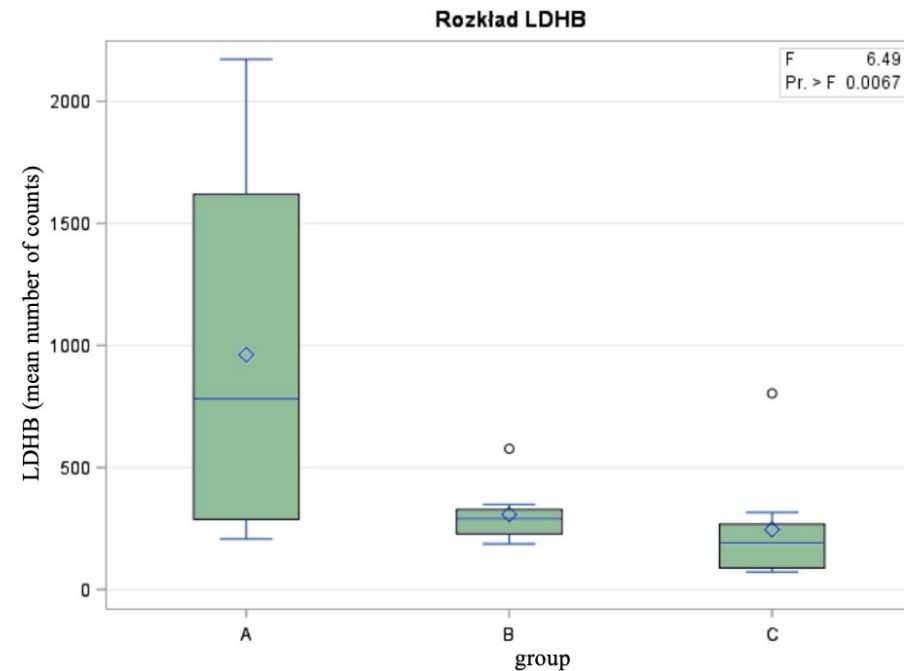
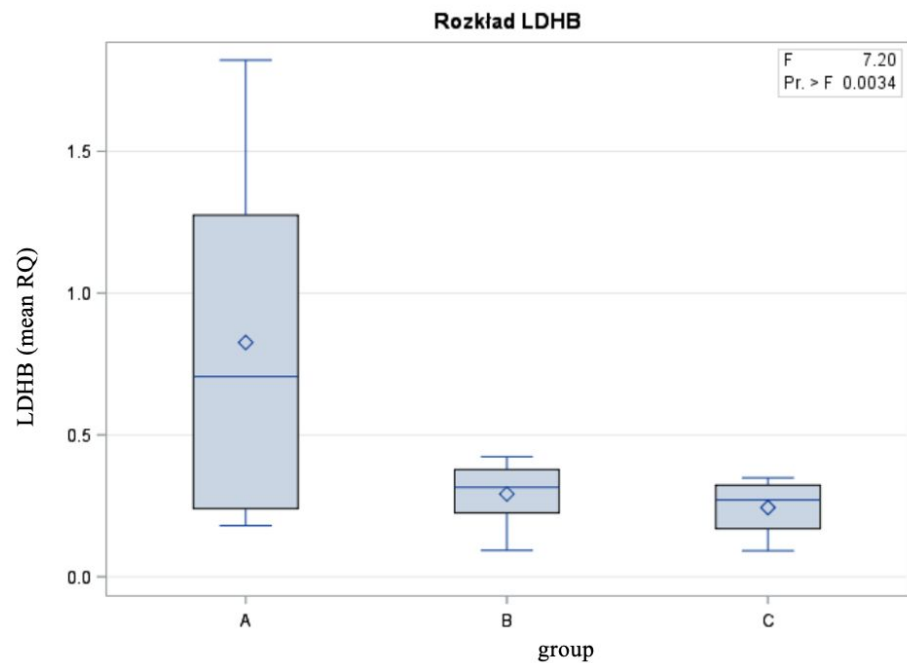
- liver samples – validation of sequencing results by RT-PCR;

RQ			Hmgcs2	number of counts		
group	mean Hmgcs2	SD Hmgcs2		group	mean Hmgcs2	SD Hmgcs2
overall	0,4871	0,5455880946		overall	349.99434844	625.60113803
A	0,9168	0,7676984072		A	824.35835425	1012.77183
B	0,2531	0,1909254945		B	135.16028973	110.07098966
C	0,2914	0,1574231382		C	149.75990206	123.1205497



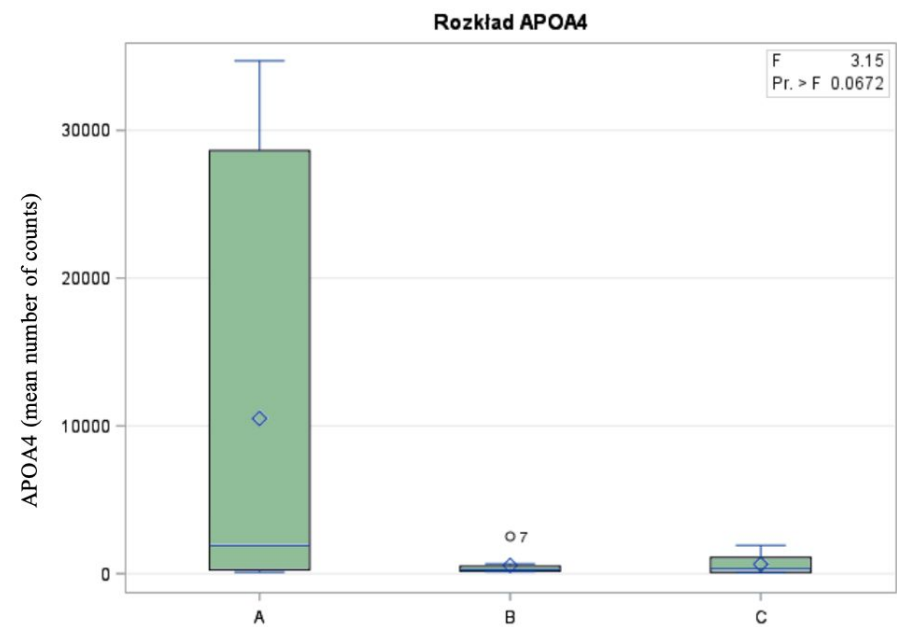
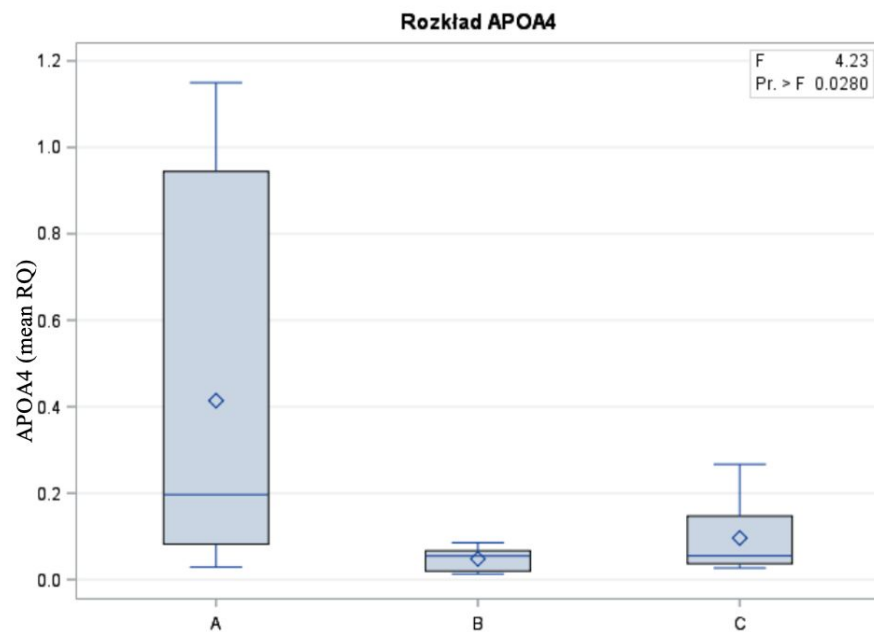
Pearson correlation: 0,74

RQ			LDHB	number of counts		
group	mean LDHB	SD LDHB		group	mean LDHB	SD LDHB
ogółem	0,4671288205	0,4514905835		ogółem	484.88493949	515.48928154
A	0,8258375454	0,607448445		A	961.49838029	711.81287055
B	0,2917133254	0,1139258911		B	306.99240078	120.55993764
C	0,2439790659	0,0916437438		C	245.7407175	240.0671938

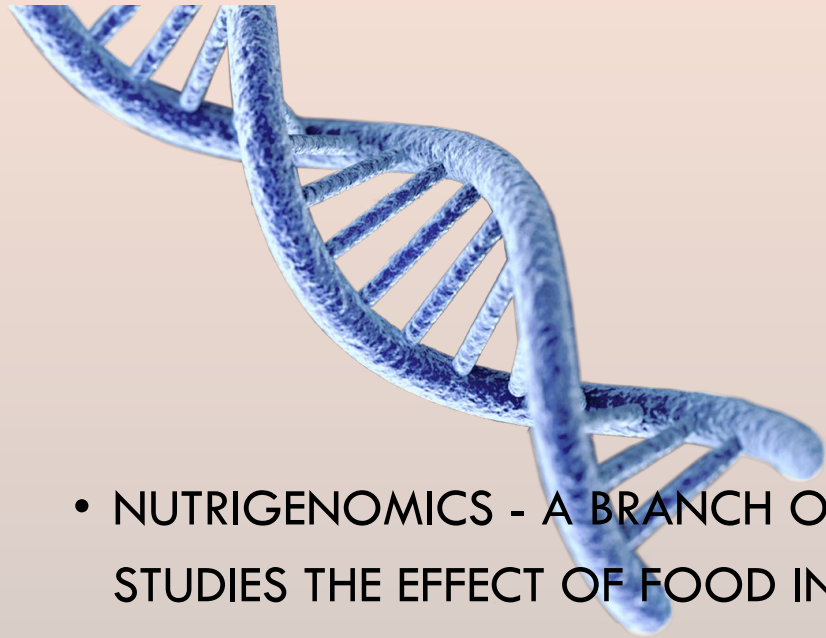


Pearson correlation: 0,69

RQ			APOA4	number of counts		
group	mean APOA4	SD APOA4		group	mean APOA4	SD APOA4
	0,2098610024	0,3249141901			3897.4400553	9399.0580108
A	0,4140128397	0,4442444582		A	10500.893359	14729.413503
B	0,0479419872	0,0265371885		B	562.82915724	807.0729019
C	0,0963503441	0,0844109876		C	639.55906547	731.24434928



Pearson correlation: 0,71



SUMMARY

- NUTRIGENOMICS - A BRANCH OF SCIENCE THAT STUDIES THE EFFECT OF FOOD INGREDIENTS ON THE REGULATION OF GENE EXPRESSION.
- NUTRIGENETICS DEALS WITH THE GENETIC DIFFERENCES BETWEEN PEOPLE, WHICH MEAN THAT WE ALL REACT DIFFERENTLY TO THE SAME DIETARY COMPONENTS.
- STAGES OF THE NUTRIGENOMIC EXPERIMENT:
 - NUTRITIONAL EXPERIMENT
 - COLLECTION OF SAMPLES
 - MOLECULAR STUDIES: RNA-SEQ, QPCR
 - BIOINFORMATIC ANALYSIS
 - DATA INTERPRETATION



THANK YOU FOR
YOUR ATTENTION

