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8. Quality of Products

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Issue: Quality of products

Quality of rabbit meat

Improvement

- Dietary selenium levels
- Waste and by-products
- Wheat sprouts extract
- Slaughtering age, age and breed

Evaluation and Characterization

- Computed tomography (fat measurement method)
- Determination of volatile compounds by gaz chromatography
- Evaluation of rabbit meat of local Algerian population
- assessment of household consumption of rabbit meat in Ibadan metropolis Nigeria

1st Research study

Inclusion of bilberry pomace in growing rabbit diets improves the nutritional quality of fat in the *Biceps femoris* muscle

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Objectives

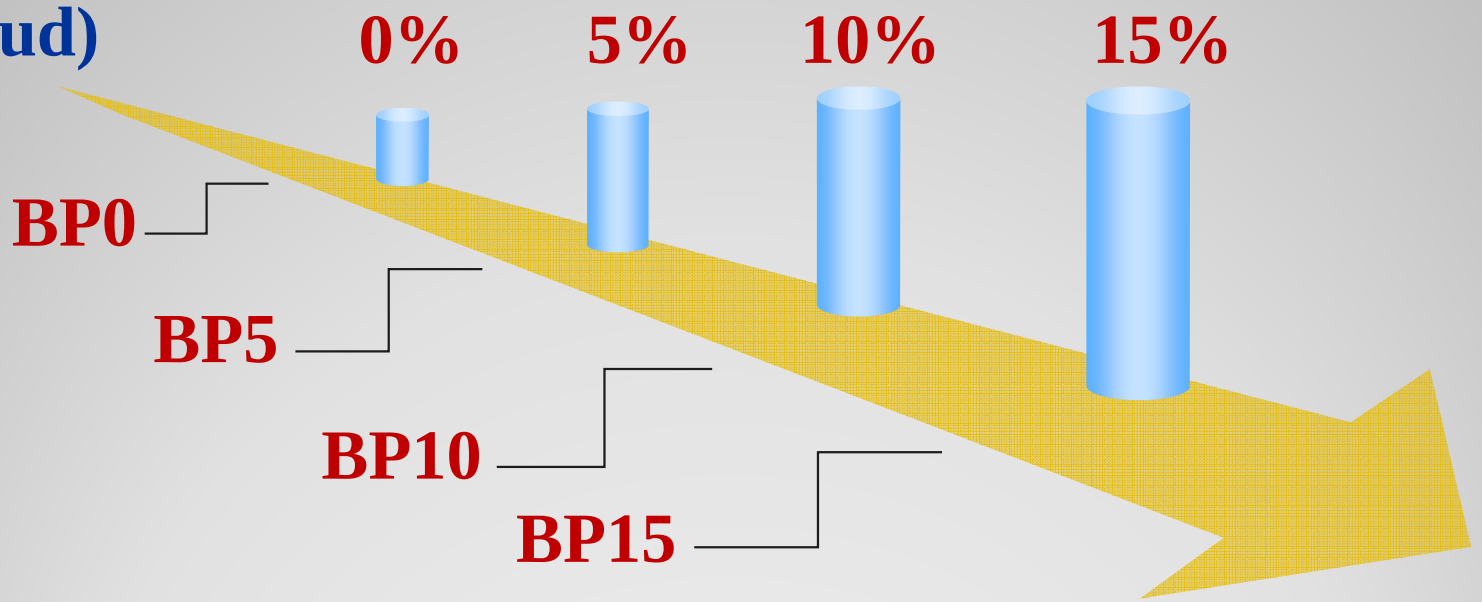
To evaluate the effects of bilberry pomace inclusion in diets for growing rabbits on physico-chemical characteristics and fatty acids profile of hind leg meat.

Materials & Methods

Animals and experimental design

36 rabbits/group

(Grimaud)



Bilberry pomace

(BP)

Materials & Methods

Data collection and laboratory evaluation

Experiment start (35 days old)

Slaughter (83 days old)

Hind leg meat

Colour indexes on *Biceps femoris* (CIE-Lab, 1976)

Cooking losses (Ramirez *et al*., 2004)

Chemical composition (AOAC, 2000)

Fatty acid profile (FA) (Belforti *et al*., 2015)

One way ANOVA (SPSS software)

Results

Quality traits of the *Biceps femoris* muscle

	BP0	**BP5**	**BP10**	**BP15**	***P***
L*	53.5	55.4	55.0	55.1	0.30
a*	-1.02	-1.21	-1.46	-1.55	0.45
b*	3.18	3.58	3.59	3.40	0.68
Cooking losses, %	23.5	23.7	22.7	23.3	0.74

No significant effects of BP were reported on meat quality traits

Chemical composition of hind leg meat

	BP0	BP5	BP10	BP15	*P*
Water (%)	74.1	74.2	73.6	73.1	0.05
Protein (%)	21.8	21.3	21.8	22.2	0.06
Ether extract (%)	2.22^{c}	2.68^{b}	2.90^{ab}	3.15^{a}	<0.001
Ash (%)	1.33	1.34	1.34	1.33	0.46

Ether extract significantly increased following increasing BP inclusion levels in the diets

Fatty acid profile (g/100g of total FAs)

	BP0	BP5	BP10	BP15	*P*
C16:0	32.6^{a}	28.9^{b}	28.6^{b}	25.6^{c}	<0.001
C16:1c	5.76^{a}	4.78^{b}	4.45^{b}	4.00^{b}	0.005
C18:0	7.31^{a}	6.65^{b}	7.08^{ab}	6.78^{b}	0.021
C18:1c9	25.0^{a}	24.1^{ab}	23.5^{b}	23.1^{b}	<0.01
C18:2n6	17.8^{c}	21.9^{b}	21.9^{b}	23.7^{a}	<0.001
C18:3n3	2.19^{d}	4.91^{c}	6.48^{b}	9.23^{a}	<0.001

A significant modifications in the proportion of the majority of individual detected fatty acids.

Fatty acid profile (g/100g of total FAs)

	BP0	BP5	BP10	BP15	*P*
ΣSFA	44.5^{a}	39.8^{b}	39.6^{b}	36.1^{c}	<0.001
ΣMUFA	34.5^{a}	32.1^{b}	31.0^{bc}	29.9^{c}	<0.001
ΣPUFA	21.0^{c}	28.1^{b}	29.4^{b}	34.0^{a}	<0.001
Σn3	2.20^{d}	4.91^{c}	6.48^{b}	9.23^{a}	<0.001
Σn6 /Σn3	8.66^{a}	4.79^{b}	3.59^{c}	2.70^{d}	<0.001
Atherogenecity index	0.83^{a}	0.67^{b}	0.65^{b}	0.56^{c}	<0.001
Thrombogenicity index	1.30^{a}	0.91^{b}	0.83^{c}	0.63^{d}	<0.001

- **A decrease of SFA and MUFA.**
- **An increase of PUFA and n3 FA.**
- **A decrease of n6/n3 FA ratio, atherogenicity and thrombogenicity indexes.**

Conclusion

Including and increasing of bilberry pomace in growing rabbit diets increases ether extract content and improves the nutritional quality of fat for human consumption.

2nd Research study

EFFECTS OF DIETS WITH INCREASING LEVELS OF CITRUS PULP ON MEAT QUALITY AND FATTY ACID COMPOSITION OF GROWING RABBITS

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Objectives

TO EVALUATE THE USE OF CITRUS PULP IN RABBIT DIET AND THE EFFECT ON MEAT QUALITY, WITH AN EMPHASIS ON INTRAMUSCULAR FATTY ACID COMPOSITION

Materials & Methods

1. Animals and experimental design

80 Ira rabbits (45-day-old)

Rabbits were divided into 4 groups of 20 (2 rabbits per group).

- Control
- 7% Citrus
- 14% Citrus
- 21% Citrus

2. Laboratory evaluation

Slaughter day (75 days old)

- *Longissimus lumburum*
- *Hind leg meat*

- Cooking losses
- pH
- Color
- Water holding capacity (WHC)
- Fatty acids

Data analysed by SPSS software, 1999

Results

Quality traits of the *Longissimus lumburum* muscle

	Control	Citrus 7%	Citrus 14%	Citrus 21%
pH	5.79^{a}	5.97^{c}	6.01^{d}	5.19^{b}
L*	55.92±1.51	56.51±2.03	58.13±0.62	56.42±2.45
a*	0.60 ± 0.04^{a}	0.36 ± 0.02^{b}	0.43 ± 0.06^{b}	0.40 ± 0.08^{b}
b*	10.17±0.41	10.21±0.30	10.61±0.34	10.78±0.47
WHC (%)	73.66 ± 0.89^{a}	72.23 ± 1.05^{ab}	71.05 ± 0.64^{b}	71.01 ± 0.82^{b}
Cooking losses (%)	17.44 ± 0.55^{a}	19.76 ± 0.26^{b}	23.66 ± 0.49^{c}	24.00 ± 0.82^{c}

- **Higher pH values in the citrus pulp groups.**
- **L* and b* were not affected by diet.**

Quality traits of the *Hind leg* muscle

	Control	Citrus 7%	Citrus 14%	Citrus 21%
pH	6.14^{a}	6.17^{b}	6.17^{b}	6.19^{c}
L*	58.64±1.66	57.53±2.17	60.09±0.72	60.09±2.12
a*	-0.41 ± 0.08^{a}	-0.47 ± 0.02^{b}	-0.51 ± 0.06^{b}	-0.87 ± 0.01^{c}
b*	9.35±0.29	9.78±0.44	9.31±0.34	9.62±0.26
WHC (%)	72.80 ± 0.26^{a}	71.23 ± 1.25^{ab}	69.16 ± 0.72^{b}	68.72 ± 0.82^{b}
Cooking losses (%)	12.31 ± 0.10^{a}	15.16 ± 0.34^{b}	19.39 ± 1.01^{c}	20.05 ± 0.62^{c}

- **Higher pH values in the citrus pulp groups.**
- **L* and b* were not affected by diet.**
- **Cooking losses values were higher in the citrus pulp groups.**

Fatty acid content of the *Longissimus lumburum* muscle

	Control	Citrus 7%	Citrus 14%	Citrus 21%
C16:0	27.45±0.46	27.37±0.10	26.98±0.22	26.89±0.18
C18:1n-9	19.18 ± 0.08^{a}	18.28 ± 0.18^{b}	17.37 ± 0.12^{c}	17.64 ± 0.15^{c}
C18:2n-6	24.65 ± 0.31^{a}	24.50 ± 0.12^{ab}	23.91 ± 0.25^{b}	23.83 ± 0.13^{b}
C18:3n-3	1.34 ± 0.03^{a}	1.21 ± 0.02^{b}	1.48 ± 0.07^{c}	1.77 ± 0.04^{d}
C20:4n-6	7.56 ± 0.12^{a}	8.55 ± 0.21^{b}	9.34 ± 0.33^{c}	9.01 ± 0.37^{c}
C20:5n-3	1.84 ± 0.03^{a}	1.99 ± 0.04^{b}	2.03 ± 0.09^{b}	1.90 ± 0.07^{a}
SFA	40.45 ± 0.20^{a}	39.89 ± 0.14^{b}	39.73 ± 0.44^{b}	39.50 ± 0.18^{b}
PUFA	38.06 ± 0.18^{a}	39.44 ± 0.26^{b}	40.35 ± 0.39^{c}	39.64 ± 0.22^{b}
n-6/n-3	6.54 ± 0.15^{a}	6.52 ± 0.09^{a}	5.55 ± 0.02^{b}	5.83 ± 0.07^{c}

- **A significant modifications in the proportion of the majority of individual detected fatty acids.**
- **An increase of C18:3n3.**
- **A decrease of SFA and an increase of PUFA content.**

Fatty acid content of the *Hind leg* muscle

	Control	Citrus 7%	Citrus 14%	Citrus 21%
C16:0	28.25 ± 0.06^{a}	27.55 ± 0.28^{b}	27.06 ± 0.14^{b}	27.32 ± 0.48^{b}
C18:1n-9	18.18 ± 0.05^{a}	18.18 ± 0.22^{a}	16.47 ± 0.08^{c}	17.77 ± 0.14^{b}
C18:2n-6	24.66 ± 0.18^{a}	25.33 ± 0.12^{b}	26.05 ± 0.17^{b}	25.36 ± 0.27^{b}
C18:3n-3	1.50 ± 0.06^{b}	1.60 ± 0.02^{c}	1.50 ± 0.05^{b}	1.28 ± 0.03^{a}
C20:4n-6	6.08 ± 0.19^{a}	7.19 ± 0.17^{b}	8.35 ± 0.25^{c}	6.91 ± 0.18^{b}
C20:5n-3	1.88 ± 0.06^{b}	1.54 ± 0.04^{a}	2.00 ± 0.09^{c}	2.16 ± 0.10^{c}
SFA	41.72 ± 0.25^{a}	40.34 ± 0.32^{c}	39.70 ± 0.14^{d}	41.04 ± 0.28^{b}
PUFA	37.59 ± 0.39^{a}	38.76 ± 0.56^{b}	41.99 ± 0.28^{c}	38.45 ± 0.43^{ab}
n-6/n-3	5.89 ± 0.11^{a}	6.94 ± 0.09^{b}	5.91 ± 0.10^{a}	6.97 ± 0.14^{b}

- **A significant modifications in the proportion of the majority of individual detected fatty acids.**
- **A decrease of SFA and an increase of PUFA content in citrus 14% group.**

Conclusion

The use of citrus pulp in growing rabbit diets had no negative effect on meat quality traits, increases PUFA content and decrease SFA content.

3rd Research study

DIETARY SUPPLEMENTATION OF WHEAT SPROUTS EXTRACT AND OXIDATIVE STATUS OF GROWING RABBIT

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Objectives

TO INVESTIGATE THE EFFECT OF ETHANOL EXTRACT OF WHEAT SPROUTS ON *IN VIVO* OXIDATIVE STATUS AND MEAT QUALITY OF GROWING RABBIT.

Materials & Methods

1. Animals and experimental design

40 New Zeeland White (30-day-old) divided in 2 groups (standard diet)

Drinking supplementation:
1.5 mL/d of ethanol Extract of Wheat Sprouts (EWS)

2. Chemical analysis

Slaughter day (80 d)
10 rabbits/ group

Blood

In vivo parameters:
Retinol; Carbonyls; Cholesterol and TBARs

2 *Longissimus Lumborum*

TBARs; Tocopherols content; retinol; cholesterol; protein carbonyls and thiols

Linear model of Stata package

Results

In vivo bioactive compounds and oxidative status of rabbits

	Control	EWS	SEM	*P*
Retinol (nmol/mL)	10.43	7.79	9.96	0.062
α-Tocopherols (nmol/mL)	0.37	0.27	0.09	0.017
δ-Tocopherols (nmol/mL)	0.05	0.08	0.04	0.082
Carbonyls (nmol mg proteins)	0.16	0.17	0.09	0.258
TBARs (nmol MDA/mL)	59.5	43.2	4.58	0.002
Cholesterol (mg/dL)	24.4	18.9	1.01	0.020

- **EWS improved the plasma lipid oxidative status.**
- **Oxidation level of protein was not affected.**
- **Cholesterol concentration was lower in EWS rabbits.**

Bioactive compounds and oxidative status of *Longissimus Lumburum* muscle

	Control	EWS	SEM	*P*
Retinol (ng/g)	140,7	179.0	21.9	0.001
α-Tocopherols (ng/g)	96.9	125.7	12.5	0.007
γ -Tocopherols (ng/g)	1.19	0.85	0.14	0.028
δ-Tocopherols (ng/g)	1.94	1.00	0.18	0.035
α-Tocotrienol (ng/g)	2.07	0.30	0.20	0.003
γ -Tocotrienol (ng/g)	9.33	13.4	2.21	0.015
Thiols (µmol SH-group/g wet tissue	8.10	6.92	1..05	0.047
Carbonyls (nmol mg proteins)	0.49	0.25	0.12	0.027
TBARs (gMDA/g)	0.12	0.10	0.01	0.020
Cholesterol (mg/100g)	47.0	42.1	2.84	0.013

- **Better oxidative status of rabbit drank EWS.**
- **Oxidation level of protein and lipid were lower.**
- **Cholesterol concentration was lower in EWS rabbits.**

Conclusion

The administration of EWS in growing rabbit

- **Improved their health status (reducing plasma TBARS)**
- **Improved meat quality (increasing the antioxidant content of meat)**
- **Reducing cholesterol concentration in plasma and meat**


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