Qualitative assessment of dairy cattle welfare

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ABSTRACT

The present study was aimed to apply a methodology recently developed for the qualitative assessment of animal behaviour to the evaluation of dairy cattle welfare. Six farms (2 tie stall - TS, 2 straw yard - SY and 2 cubicle systems - CU) were filmed to produce six 3.5 min videos. Each of them contained 4 clips: - overall view of the barn (1 min); - feeding (1 min); - milking (1 min); - zoom on individual animals (30 sec). Ten University students were selected on the basis of their sensitivity to animal welfare issues and instructed to provide qualitative assessment of videos using Free Choice Profiling (FCP) methodology. Data gathered from FCP were subjected to Generalized Procrustes Analysis (GPA). GPA showed a significant consensus among observers (P<0.001). The 2 main dimensions of the consensus profile explained 39.5 and 26.8% of the total variation, respectively. Observers characterised the first dimension with terms ranging from constractive to comfortable, unrestricted conditions and the second one in terms of cleanliness/dirtiness. Farms TS scored less on the first dimension, being more restrictive and coercive than SY (P<0.05) and CU (P<0.10), whereas no differences were observed between these two latter systems. On the second dimension CU received scores higher than SY (P<0.10) as the former were considered cleaner and more hygienic. Principal Component Analysis (PCA) was conducted using the scores of the farms on the first two dimensions of GPA and the data gathered through the Bartussek et al.’s ANI 35L 2000 scheme by trained assessors. The two main dimensions of PCA explained 91% of the total variation. The first dimension of GPA (unrestricted; 0.39), ANI's sheet 1 (Locomotion; 0.42), sheet 2 (Social interaction; 0.42) and sheet 6 (Summary scores; 0.43) showed higher loadings on the first component of PCA, whereas the second dimension of GPA (cleanliness; 0.61), sheet 3 (Flooring; 0.45) and sheet 4 (Stockmanship; 0.49) were more correlated with the second component of PCA. We concluded that qualitative assessment may be used for the evaluation of dairy cattle assessment by untrained observers thus providing a potential tool to address public concerns about animal welfare.
Effect of parity on the feeding behaviour of dairy cows

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ABSTRACT

The trial was carried out on Italian Friesian cows raised in an experimental free stall barn. The cows were fed once daily (TMR administered at 07:00) and milked twice daily (at 03:00 and at 15:00). During the trial, 9 check points, throughout the seasons, were planned to observe feeding behaviour of cows raised in a pen equipped with 24 (1 per cow) feeding stations (Bio Control A/S). At each check point, were continuously observed (per 3 days) 18-20 lactating cows for feeding behaviour parameters; finally, were obtained data of 46 cows, 18 primiparous (PR) and 28 pluriparous (PL), between 50 and 250 DIM. Indexes of feeding behaviour, collected and automatically registered by the system, were number of visits, intake per visit and duration of visit. Indexes of feeding behaviour calculated were number of meals (considering the same meal when the interval between the visits was lower than 20 minutes), intake per meal, duration of meal and consumption rate. These indexes have been studied during the 24 h, in daytime (from 07:00 to 19:00) and in night time (from 19:00 to 07:00). At each check point, was also recorded the individual milk yield, the TMR composition and its DM content. Primiparous had a slightly lower milk yield and a lower average DMI (19.25±2.89 vs. 20.77±3.24 kg DM/d, in PR and PL respectively). In PR, despite lower DMI, a higher number of meals in the 24 h (7.72±2.13 vs. 6.72±1.83, in PR and PL respectively) with a lower DMI per meal (2.67±0.79 vs. 3.27±0.81 kg DM/meal, in PR and PL respectively) and a lower consumption rate (96±20 vs. 118±26 g of DM/min, in PR and PL respectively) was observed. In addition, a higher number of visits per day and visit per meal was observed in PR. DMI during diurnal hours was 74.61±11.69% of daily DMI in PR and 75.09±11.54% in PL, and it was concentrated after feeding distribution (at 07:00) and after evening milking (15:00). In conclusions, our data show that primiparous cows need more time to chew feeds, and this should be considered important in creating feeding strategies that aim to best feed activity and stimulate intake, particularly at the beginning of lactation and when PR are raised with PL.
Raw, extruded and expanded pea (Pisum sativum) as alternative protein sources in dairy cows diets

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ABSTRACT

The ban of the meat and bone meal for entering animal diets and the concern of transgenic feeds pose a challenge to animal nutritionists in Europe. The challenge is to find homegrown protein-rich feedstuffs, making sure no antinutritional factors are present which could interfere in the animals' performance. The objective of the study was to evaluate the nutritive value of raw pea, extruded pea or expanded pea relative to soybean meal and barley (to balance the starch content) in lactating dairy cows. Twenty four Italian Holstein cows (8 primiparous and 16 pluriparous), 610±25 kg body weight, 34.5±2.5 kg milk yield, were randomly assigned to four dietary treatments in a 4x4 latin square design with periods of 30 days and washout period of 7 days. The alternative protein sources partially replaced the soybean meal in reason of 12.5% on diet dry matter basis. Diets had a 1:1 forage to concentrate ratio (on dry matter basis) and were fed ad libitum (5% orts). According to an average diet dry matter intake of 22.3 ± 0.5 kg cows received about 2.79 kg pea. The bulk of the base diet was corn silage (31.2%), alfalfa hay (16.7%), grass hay (4.1%), protein supplement (10.3%), whole cotton seed (8.5%), corn and barley mix (24.9%), soybean meal (3.4%) and Megalac (0.9%). Daily milk yield was recorded and milk quality (fat, protein, lactose and coagulation parameters by tromboelastographic method) was determined. Three animals per group were randomly selected for blood (9 a.m.), rumen (at 3 hours after morning meal: pH, volatile fatty acids) samples collected in the last week of the treatment period. The 4% fat corrected milk yield was calculated and the group dry matter intake and fecal score were recorded. No statistical differences were detected among treatments for the observed parameters. Data support the partial substitution of soybean and barley with pea, either raw or processed in diets for lactating dairy cows without negative effects on milk yield and quality. However, the effort of the technological treatments put into the processed feed could not be justified by the cost to benefit ratio.
Impact of automatic milking system (AMS) on milk yield and some milk characteristics

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ABSTRACT

The trial was carried out in the experimental free stall barn “V. Tadini” equipped with an auto tandem (4+4) milking parlour and, since March 2004, with a single box automatic milking system (Galaxy, Milkline). Two similar herds were constituted and milked with milking parlour (MP) or with automatic milking system (AMS). The cows of the two herds were fed the same diet distributed using TMR technique, once a day (at 07:00). The cows in MP were milked twice daily (at 03:00 and at 15:00). After AMS installation the AMS herd was constituted of 20 mid-lactating cows, moved from the MP herd. In the next months other cows were introduced in the AMS herd, reaching a numerousness of 26 cows. In the AMS area forced cow traffic was applied. During the trial, started one month before and ended four months after AMS installation, individual milk yield was daily recorded and bulk milk of the two herds was sampled fortnightly and analysed for fat, protein, lactose and somatic cell count (SCC). Data on cow traffic in the AMS were obtained from the recorded visits in the milking unit. Milking frequency in AMS, excluding the first 3 weeks after AMS installation, averaged 2.61±0.78 milkings/day. Milk yield decreased, according to the advancing in the lactation phase, in both herds and the extent of the reduction was slightly lower in the AMS herd. Slight differences were observed in fat content of bulk milk with a reduction of the values in both herds in springtime. On average the values were 3.70±0.15% in AMS and 3.77±0.06% in MP, with a higher variability in AMS herd. Protein content was 3.37±0.05% in AMS and 3.33±0.17% in MP and the values observed in each herd during the trial have shown a similar pattern. Lactose content of bulk milk decreased, during the trial, in a lesser extent in AMS. Milk SCC were, on average, 5.58±0.16 log_{10}(n/mcl) in AMS and 5.60±0.07 log_{10}(n/mcl) in MP and a very close pattern during the trial was observed in the two herds. In conclusions our data show that the introduction of the AMS increases slightly milk yield with minor influence on milk composition and without effect on somatic cell count.
NIR analysis of capillary butterfat in correlation with fatty acid composition of milk and cheese

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ABSTRACT

Aim of the trial was to examine the NIR technique for a rapid and early characterisation of lipids composition of milk and, eventually, of the corresponding manufactured cheese. From 55 Valdostana red pied cows reared at an experimental station in Sauze d’Oulx (TO), 28 samples of milk cream and 13 samples of Toma cheese were collected, then stored at -20°C. The thawed creams were centrifuged at 20,000 rpm, for 20’ in a glass haematocrit capillary. Then the lighter pole was scanned by a FT-NIR PE Spectrum IdentiChek instrument. Lipid extraction was performed both in milk cream and in cheese according to Hara and Radin and transesterification of fatty acids according to Christie, with modifications described by Chouinard et al. Fatty acid methyl esters in hexane were then injected into a gas chromatograph equipped with a flame ionization detector (FID) and a PTV injection port. Separation of fatty acid methyl esters was performed with a Supelcowax-10 fused silica capillary column (60m x 0.32 mm (i.d.), with 0.25 µm film thickness). The FT-NIR spectra of cream and cheese were calibrated, then internally cross-validated in 12 subgroups, allowing one passage for outliers elimination (NIRS2 software) resulting the descending 1-VR values >0.26 (for Milk cream: C18:1n9 = 0.67; C6:0 = 0.65; C4:0 = 0.58; C18:0 = 0.57; C16:0 = 0.52; C8:0 = 0.50; C14:0 = 0.50; C18:1n7 = 0.50; C10:0 = 0.48; CLA = 0.46; week of production = 0.32; for Cheese: C16:0 = 0.88; C14:1 = 0.78; C12:0 = 0.77; C18:2n6 = 0.66; week of production = 0.65; C4:0 = 0.60; C16:1n7 = 0.54; C14:0 = 0.51; C18:1n9 = 0.51; C15:0 = 0.50; C18:3n3 = 0.50; C17:0 = 0.27). It was unfortunately enhanced a lack of correlation with CLA in cheese compared to milk cream (0.46). However, because of many appreciating results in eleven fatty acids (FA), this rapid methodology ought to be confirmed both for milk FA composition and for predictability of some FAs in the future cheese.
Effect of the chromogenic substrate on the colorimetric determination of plasmin and plasminogen in milk

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ABSTRACT

Several methods have been developed to evaluate the activity of the plasmin-plasminogen system in milk of different species. The most common procedures are colorimetric determinations which mainly apply two chromogenic substrates: D-Val-Leu-Lys 4-nitroanilide (VAL) or N-(p-Tosyl)-Gly-Pro-Lys 4-nitroanilide (TOSYL). It is therefore hard to carry out a comparison between results obtained by different authors. The present study aimed at evaluating the possible effect of these two chromogenic substrates on the colorimetric determination of the plasmin-plasminogen system in milk. Fifty-six samples of bovine milk and forty samples of ovine milk were collected from animals in different phases of lactation and were assessed for plasmin (PL) and plasminogen (PG) activities with the same method, using both VAL and TOSYL. The mean values of PL (VAL vs. TOSYL) were 6.58 vs. 4.31 U/ml and 15.49 vs. 27.25 U/ml respectively in bovine and ovine milk; those of PG were 26.10 vs. 23.49 U/ml (bovine) and 16.07 vs. 26.13 U/ml (ovine). In order to investigate the possible linear relationship between results obtained with the two substrates, a linear regression approach was adopted, assuming respectively TOSYL-PL and -PG values as dependant and VAL-PL and -PG as independent variables. The regression coefficients (intercept and slope) for PL were 0.059 and 0.646 in bovine, 8.185 and 1.231 in ovine milk; those of PG were 15.038 and 0.324 (bovine), 14.116 and 0.748 (ovine). The values of R² were: 0.741 and 0.861 (bovine and ovine respectively) for PL; 0.672 and 0.612 in the case of PG. The distribution of residuals and R² values seems to suggest a better fit in the case of PL than in the case of PG. Results point out two major phenomena: first of all a divergent response to the chromogenic substrate was detected in the determination of PL between the two species, as highlighted by the different mean values and by the intercept of the regression curve; secondly, VAL and TOSYL might differently affect the conversion of PG to PL, that takes place during the assay, and thus decrease the linearity between results obtained with these two substrates.
Aflatoxins in the milk from organic farms in Tuscany

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ABSTRACT

It is estimated that up to 25% of the world's foods are contaminated with mycotoxins. The most frequently occurring mycotoxins are aflatoxins (AF). Major foodstuffs contaminated with AFB and AFG include maize grains and derivatives, maize silage, ground ear corn, cotton, peanuts, linseed cake, barley, corn gluten and hay. The AFM1 and AFM2, known as “milk toxins”, are hydroxylated metabolites of AFB1 and AFB2, which are produced by liver cells of animals that ingest contaminated food. AFB1 is a Class 1 carcinogen, whereas AFM1 is a group 2B carcinogen. It is believed that risks linked to AF contamination are higher in organic production than in conventional milk production. In Tuscany, a crisis regarding AFM1 contamination of milk occurred in both conventional and organic farms during the autumn of 2003. The objective of our work was to establish that the risks linked to AF contamination of milk are equal in organic and conventional milk production, and that it is possible to produce milk that is safe for human consumption by adopting the necessary preventive measures. A statistical analysis was carried out on conventional and organic milk from data (HPLC) supplied by the Dairy Centre of Florence, Pistoia and Livorno (Mukki Latte). From the analyses carried out on two organic farms in the Mugello area and one in the Lazio region, it is shown that AFM1 levels were lower than the levels recorded in conventional farms. In fact, after the contamination peak between October – November 2003, the AFM1 levels decreased <50 ppt (legal limits), due to the appropriate measures taken. Those organic farms, which had the same problems as the conventional farms, reacted immediately by increasing sanitary control to a higher level than that adopted by conventional farms. Possible solutions to prevent a new AF crisis, both in organic and in conventional farms, are the following: - preventive analysis on milk and feed produced and bought by using a rapid kit, - using early cultivars of maize to foreword the harvest date, - adopting crop rotation and other agronomic practices, - adopting a harvesting system that would prevent seed breakage, - drying of the maize seeds before keeping.
Periurban livestock for milk production in Africa, Niamey (Niger): a town study

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ABSTRACT

In the last years the process of urbanization and the population growth caused a change in food needs of big cities in the Sahel area. The increasing demand of milk and derivates is fulfilled by the import of big quantities of dried milk from the surplus countries. Local milk production should be improved to permit these countries to unburden themselves of their economical ties and to reduce the health problems related to the use of dried milk. The aim of this study was to obtain the livestock, social and economic information of two periurban camps just involved in a previous dairy project in Niamey (Niger). The study used a questionnaire concerning the farmer’s personal data, the herd live data, herd distribution, livestock management and veterinary practices, the animals health and the valorization of milk production. The questionnaire, translated from French into Fulfuldé (Peuhl native language), was structured in questions without multiple choices and it has been carried out from 15 April to 30 May 2003. The questions were asked individually, so that one farmer could not influence the others. The census involved 81 farmers, 1,433 cattle (48.7% in the periurban area, 51.3% in the pastoral area). The zebu cattle breeds (Bos Indicus) were: Azaouak (28%), Djeli (49%), Goudali (1%), and Bororo (22%). The milking cows were 41% in the periurban area. The average milk production was 0.5-1 liter in dry season and 1-2 liter in raining season. The seasonal incidence of diseases is particularly high during the dry season; digestive disorders, due to ingestion of inedible material (mainly plastic bags), sickness afflicting the respiratory and the urinary systems, some cases of heat-strokes, nervous and locomotion disorders, and some cases of canker (injuries located mainly in the tongue) are those largely mentioned from the farmers. This study has identified many constrains to the development of milk production; solving these problems will permit to improve milk production in urban and periurban Niamey area.
The hypertrophied Marchigiana: body measures and slaughtering yields

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ABSTRACT

Aim of the trial was to evaluate the productive performance of double muscled Marchigiana beef calves. Body measures and slaughtering yield were controlled on animals with different genotypes: normal (N=7) and hypertrophied (homozygous, Ho=6; and heterozygous, He=12). The genotype identification was performed by a rapid PCR-RFLP test for the myostatin gene (AF320998). The mutation is a G to T transition at nucleotide 874 in exon 3, known as E291X. Live weights and 32 body measures, such as Hips arch-max buttocks, Pins arch-femur tibia articulation, etc., devoted to determine the muscle hypertrophy were collected on 25 calves at fifteen months, the differences between the three genotypes were estimated also by three zoometric indexes (Max width of rump/width of hips, Max length of rump/rump length, Arch/chord pins-femur tibia articulation). Because of the low number of animals in the sample, any statistical approach was not suitable, therefore all the data were expressed by their simple mean. At slaughtering (different weights and ages by genotypes) carcass and organs were weighted and SEUROP evaluation was performed on 19 subjects (N=6; Ho=3; He=10). Data showed later slaughtering age (N=590 d; Ho=565 d; He=546 d) in the animals with normal genotype respected to the others; the weights were heavier in the heterozygous (N=696 kg; Ho=487 kg; He=676 kg). Moreover, some body measures such as trunk length (N=153 cm; Ho=156 cm; He=160 cm), width of shoulders (N=47 cm; Ho=56 cm; He=54 cm) and width of rump (N=58 cm; Ho=61 cm; He=59 cm) showed the best conformation of the hypertrophied homozygous. Slaughtering data showed that in the homozygous subjects the less percentage of the lungs, liver and heart (N=2.7%; Ho=2.1%; He=2.5%). Dressing percentage was higher in the homozygous hypertrophied beef calves (N=63.3%; Ho=67.4%; He=63.9%), and the SEUROP carcass evaluation (in class E: N=0, Ho=2, He=2) also confirmed the excellent conformation of such animals. Finally, the results confirmed that the Marchigiana double muscled beef calves showed, as all hypertrophied animals, a particularly devoted to meat production morphology.
Influence of rearing system on body measurements in Piemontese young bulls

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ABSTRACT

Morphological characteristics of animals, as size and shape, can change according to breed, sex, age, physiological status and, also, rearing system. To evaluate such changes, besides live weight, several linear body measurements have been used, to allow researcher to better understand where the modification taken place. As in last years the traditional rearing and fattening systems of Piemontese cattle is changing from tied stall to free range, a trial has been planned to evaluate the influence of rearing systems on body measurements of double muscled young bulls. The trial has been carried on hypertrophied Piemontese young bulls, 15 reared in tied stall (TS) and 15 in pen for groups (GP). The animals, of the same age (about 7 months) and live weight (230 kg), were reared under the same environmental conditions, following the same feeding system and nutritional level (for a daily gain of 1.2 kg), with a fixed amount of hay (2 kg/day, 0.55 UFV/kg) and increasing amount of concentrate (0.95 UFV/kg) to meet the increasing energy and protein requirement, according to the INRA scheme for late maturing beef breeds. Few days before slaughtering, at about 16 months of age, live weight and 14 body linear measurements were recorded on all animals. Data were analysed by GLM ANOVA procedure. Significant differences were found between TS and GP animals only in live weight (539.1±56.48 vs. 579.1±26.97 kg, P=0.019), in chest height (63.4±2.72 vs. 66.0±2.78 cm, P=0.015), in body length (143.5±8.85 vs. 151.0±7.27 cm, P=0.017), in rump length (55.0±2.75 vs. 57.1±2.26 cm, P=0.028), and in chest girth (195.9±5.00 cm, P=0.001), all higher in GP animals than in TS. For all other measurements (i.e. withers height, rump height, pin height, chest length, chest width, hip width, rump width, pins width, buttock girth, shank girth) no differences were found according to rearing systems. The low appreciation of the free rearing system by dealers and butchers, due to traditional practices, is therefore not justified by differences in live performances or body shape: in fact the GP animals not only are heavier, but also longer and with a more developed chest than the TS animals.
Influence of rearing system on histochemical and morphometric characteristics of muscle fibre in Piemontese young bulls

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ABSTRACT

Muscular fibres could be classified as αW, βR and αR according to structure, acting and metabolic characteristics, important not only in physiological studies, but also in determining the meat quality obtained from the skeletal muscles. In muscles all these three kinds of fibres can be observed, even if transformation from one to another type could occurred due to growth, exercise and so on. As in last years the traditional rearing and fattening systems of Piemontese cattle is changing from tied stall to free range, a trial has been planned to evaluate the influence of rearing systems on muscular fibres characteristics in double muscled young bulls. The trial has been carried on Gastrocnemius and Triceps brachii muscles of hypertrophied Piemontese young bulls, 15 reared in tied stall and 15 in pen for groups and slaughtered at about 16 months of age and 500-600 kg of live weight. Muscle samples have been taken, frozen and stained following the adenosine-5-triphosphate method for microscopic examination then measured. Data on fibres dimension (area, equivalent diameter, maximum and minimum axis, perimeter) have been studied by GLM ANOVA procedure, taking in account rearing system, muscle, fibre effect and their interaction, and means compared by Newman-Keuls's test. For all studied parameters significant effect of rearing systems (P<0.01), fibre type (P<0.01) and muscle-fibre interaction (P<0.05) has been pointed out. All parameters (except minimum axis) showed always higher values in animals reared in pen than in tied stall ones (i.e. area 3006±1235 vs. 2592±653 µm²) and αW fibres always show the highest values compared to the αR and the βR (i.e. area 3648±1814 vs. 2460±874 and 2290±673 µm²; in αW, αR and βR). In the muscle - fibre interaction the differences regards only the white fibre, that showed higher values in Gastrocnemius compared to Triceps brachii m. (i.e. area 4026±1517 vs. 3270±1101 µm²), while other fibres were similar in both muscles. The size differences found in fibres dimension in animals reared in tied stall compared to those reared in pen for groups seems justify the preferences for the old rearing system by dealers and butchers.
Natural coloured tracers in milk powder for veal: first results on meat colour

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ABSTRACT

The Italian law (L. 250, on 10 August 2000) decrees the presence of some natural markers in milk foodstuffs to detect their use in products for humans. Aim of this study is to evaluate how these markers could affect growth performances, carcass characteristics and meat quality of milk fed veal. Sixty-nine Friesian calves were reared with three different food plans: the first group was fed with reconstructed milk powder without marker (MC), the second one with reconstructed milk powder traced with dehydrated tomato peel (MT; 1% of marker) and the last one with reconstructed milk powder traced with dehydrated alfalfa (MA; 1% of marker). The animals were slaughtered at 6 months (237 kg of live weight and 140 kg of carcass weight). 24 h after slaughtering the carcasses were evaluated by an expert, using the EU-system with 4 colour classes (white = W, light pinkish = LP, pinkish = P, and red = R). After 6 days from slaughtering, dissection was performed to estimate tissue composition and samples of \textit{longissimus thoracis} were obtained from 8\textsuperscript{th}-6\textsuperscript{th} ribs. Several physical parameters (pH, drip loss, myoglobin only on meat samples; lightness, redness, yellowness, with CIELAB system; visual reflectance spectra between 360-740 nm, on meat and on pelvic fat) were determined. Carcass colour and conformation score did not show statistic differences, while MT animals showed leaner carcasses (MC and MA vs. MT fat score, 2 vs. 1+ with P<0.05). Also the fat percentage, estimated by sample dissection, was lower in MT animals than the other groups (14.04 vs. 15.88%; P=0.054). The pH was similar for the three groups (5.63), while drip loss was lower in MT compared to the other two groups also if not significantly (0.99 vs. 1.21%; P<0.2). The MT meat showed lower redness (7.24 vs. 8.29 MC group; P<0.05) and yellowness (14.75 vs. 15.59 MC group; P=0.05) indexes; also fat lightness was lower compared particularly to MC group (79.23 vs. 81.57; P<0.05). Generally, for the considered parameters, there were no differences between MA and MC and therefore the dehydrated alfalfa could be used as marker in milk powder for veal.
Effect of three rearing systems on beef meat quality

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ABSTRACT

This work aimed to verify the effect of three rearing systems using different poliphyta hay on beef meat quality. The trial was conducted in 10 farms located either in the Leonessa Mountain (group A), or on the hills (group B) and land (group C) of Rieti province. 36 young bull, belong to a local genotype obtained by cross-breeding between Chianina e Marchigiana breeds were reared following caw-calf system. After weaning, they were kept in pens and feed with concentrates (maize and barley meal) and poliphyta meadow hay ad libitum for A and B groups and alfalfa hay ad libitum for C group. The animals were slaughtered at about 15 months of age, at 412 kg of live weight on average. At dissection (6 days after slaughtering) for each animal a sample between the 12th and 13th rib was removed. The samples were dissected to estimate the tissue composition of the carcass. Subsequently on the longissimus thoracis, free water, shear force on cooked meat, lightness, redness and yellowness index, chrome and hue, dry matter, fat, ash and protein, were determined. The rib samples of animals reared on land showed a higher percentage of meat (+3% compared to hill animals and +6% to mountain animals, P<0.05) probably because they showed lower bone percentage compared to hill animals (-1.65%) and lower fat percentage compared to mountain animals (-3% for intermuscular fat, P<0.001). The free water amount did not differ between groups (19.84% as average) even if slightly higher is the value of land animals (20.20%), this value was associated with the lower percentage of meat dry matter. The shear force data were not significantly but showed progressive lessening (5.92, 5.41, 5.01 kg) from the mountain animals to land. The meat of group C showed significantly lower redness index compared to the other groups (11.09 vs. 13.50 on average, P<0.05), probably due to the lower physical activity. Also the meat chemical quality of the three rearing systems was different; in fact, the percentage of dry matter was higher in hill and mountain animals, land animal meat had higher ash percentage, while hill animals showed fatter meat. Therefore, considering data analysis, rearing systems could influence meat quality.
In *vitam* and *post mortem* performances in Limousine x Rossa Siciliana cattle under different rearing systems

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ABSTRACT

The trial aimed to evaluate the influence of two different rearing systems on growth performances and on dressing percentage of 28 Limousine x Rossa Siciliana cattle. The animals were divided into two groups similar in body weight, age and number of subjects: 14 in tied stalls (TS) and 14 in pen for groups (PG) and were reared for 200 days under the same feeding conditions with 2 kg/d of wheat straw and 1.5 kg/100 kg l.w. of concentrated (Crude Protein: 20.55%; Crude Fat: 3%; NDF: 20.44%). At the end of the rearing trial, all the animals were slaughtered at a body weight of 508±37 kg (TS) and 502±45 kg (PG), at the age of 15±2 months and hot carcasses weighed. No significant difference was shown on average daily gain between the two groups (1.18±0.25 kg/d and 1.18±0.19 kg/d; P=0.197, for TS and PG respectively). For both groups the food conversion rate was calculated and it was 5.93 and 5.90 kg/kg for the first and second group respectively. No significant differences were reported between the two groups for carcass weight (306±54 and 275±67 kg; P=0.453, for TS and PG respectively) and for hot dressing percentage (60.23±5.23 and 54.78±4.15%; P=0.382, for TS and PG respectively).
Effect of slaughtering age on meat qualitative traits of Limousine x Rossa Siciliana cattle

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ABSTRACT

Aim of this study was to evaluate the effect of slaughtering age on meat qualitative traits of 50 Limousine x Rossa Siciliana cattle. The animals, up to the age of 8±1 month were reared extensively on pasture with the cows, then moved into pens with external paddocks, and fed with 1.5 kg/100 kg l.w. of concentrated (Crude Protein: 20.55%; Crude Fat: 3%; NDF: 20.44%) and 2 kg/d of wheat straw. Animals were slaughtered at three different ages: 10-12 months (n = 14), 14-16 months (n=18) and 18-22 months (n=18). Samples of Longissimus thoracis et lumborum muscle were taken and analysed for: colour, cooking loss, tenderness and chemical composition, and data were analysed by GLM procedure. Colour parameters showed significant differences (P<0.05) in redness index, between the first (a*: 21.06) and the third class (a*: 23.73) and between the second (a*: 20.84) and the third class; and in chroma between the second (C: 20.84) and the third class (C: 23.73). Lightness (L*: 43.25, 41.43 and 41.59 at age 10-12, 14-16 and 18-22 months respectively); yellowness index (b*: 9.47, 8.60 and 8.45 at age 10-12, 14-16 and 18-22 months respectively); hue (H: 24.78, 22.34 and 19.83 at age 10-12, 14-16 and 18-22 months respectively); cooking loss (26.71, 26.25 and 27.34% at age 10-12, 14-16 and 18-22 months respectively) and tenderness (3.51, 3.65 and 3.93 kg/cm² at age 10-12, 14-16 and 18-22 months respectively) were not significantly influenced by slaughtering age. The meat chemical composition was not significantly influenced by slaughtering age, with a crude protein content of 23.10% and a crude fat content of 1.75%. In conclusion, the different slaughtering age showed a significant influence on some parameter of meat colour, with a maximum value of a* and C for cattle slaughtered between 18 and 22 months, but even when the slaughtering age increases, the meat maintains its tenderness and an acceptable cooking loss.
National project “Technological processes affecting safety and qualitative characteristics of meat based products” (SIQUALTECA): project frame

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ABSTRACT

In the last few years meat industry is interesting in pre-packing products for their easy cooking preparation, such as portioned and meat products. For these products is also required a greater guarantee through the application of the traceability. Consumers, in fact, request more sure and “natural” foods, with greater differentiation and easiness of consumption. Consumer’s attention and knowledge are increasing, up to influence productive processes. Aim of the project was to define kind and intensity of the possible effects induced by specific technological processes on the hygienic and qualitative traits of meat based products. Regarding to hygienic aspects of meat products healthiness and safety were outlined; while chemical, physical, sensorial, technological and nutritional characteristics were analysed for qualitative and shelf life aspects. Pre-transformation, transformation, packaging and conservation phases of meat and meat based products were investigated. The sectors involved in the project were poultry, swine and cattle. In poultry sector, dealt by Bologna University and “AL COOP - Poultry Breeders” co-operative producers, study on breadcrumbs covered meat products using innovative technological processes and technological coadjutants were carried on. In swine sector, dealt by Parma University, saturate steam treatment efficacy on the carcasses was evaluated, in order to reduce pigskin microbial contamination and to eliminate carcass contamination from evisceration. On fresh beef, all main qualitative parameters were examined to evaluate shelf-life, considering consumer’s acceptability and safety through lipid and protein oxidation; so as use of packaging film with antimicrobial agents “food grade”, dealt by Animal Husbandry Research Institute in Monterotondo. Microbiological aspects, dealt by Naples and Teramo University, were developed monitoring the pathogen microrganisms populations.
The SIQUALTECA project: qualitative characteristics of fresh beef coming from industrial production chain

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ABSTRACT

An important factor limiting fresh meat shelf-life is the loss of red colour stability and the increase of oxidation products. Surface red colour can be maintained for 3-4 days on beef cuts packaged in modified atmospheres containing oxygen for bloom, but lipid oxidation accelerates. Recently several innovative technologies to improve shelf life of meat were performed. Aim of this research was to estimate the quality characteristics of meat if marketed under modified atmosphere packaging (MAP). Meat samples (n=192) stored in MAP, half top sirloin steak (L) and half carpaccio (C), were subdivided into 4 thesis: muscles were cut and stored in MAP at dissection (L1, C1); samples were first maintained in vacuum packaging for 7 and 21 days and then cut and stored in MAP (L2, C2; L3, C3); last samples were protected with active films (L4, C4). pH, water loss, colour, oxymyoglobin, metmyoglobin, TBARS, and proteolysis analysis at three conservation times (3, 7 and 11 days) were determined. pH was significantly higher (P<0.01) in L1 and C1 samples (5.7), influencing thus positively the water holding capacity. Meat colour showed higher lightness with the increase of ageing time from thesis 1 to thesis 3 (41.8, 42.1, 43.9 respectively for the three thesis with P<0.05), while redness, chroma and hue had similar values among thesis. However, C stored for 11 days was darker (12.8 vs. 14.1 for redness, P<0.05). Fat oxidation was emphasized from 3 to 11 days of conservation, for C and L samples TBARS values were 1.1 mg/kg and 4.5 mg/kg respectively (P<0.001), but TBARS in L4 and C4 groups were significantly lower, mainly after 11 days of conservation, going from 0.8 to 3.5 mg/kg (P<0.05). The proteolytic process was particularly emphasized in the C samples if unprotected by active film. Raw L, packaged in enriched oxygen MAP, had a desirable brightness red colour due to a high percentage of oxymyoglobin on 7 day storage samples (63.2 and 56.2% at 3 and 7 days respectively P<0.001), but some brownish colour was evident at 11 days (+16 and +11% of metmyoglobin compared to 3 and 7 days respectively).
Tenderness variation depending on ageing in Piemontese beef

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ABSTRACT

An adequate ageing is considered a basic strategy to improve meat tenderness; however the length of ageing frequently tends to be shortened, in consideration of its negative influence on other meat characteristics, like colour and WHC. The trial aimed to study the variations of tenderness (WBshear), colour and WHC, due to different ageing periods. Samples of longissimus thoracis et lumborum (LTL; 9° T.V. - 1° L.V.) were taken 24h p.m. from 31 Piemontese young bulls. Each LTL was divided into 5 subsamples, which were assigned in rotation to 1, 3, 7, 11, 15 days of ageing (d1, d3, d7, d11, d15). The sub samples for 3÷15 days of ageing were vacuum packaged and stored at 3°C until day of analysis. The analyses were: colour (lightness, chroma and hue); drip losses; WBs (kg; cylindrical cores, 2.54 cm in diameter) of meat cooked in water bath at an internal temperature of 70°C. Data were analysed by GLM repeated measures procedure, with day of ageing as fixed effect. Lightness resulted higher (P<0.05) at d3 in comparison with d1 (33.27), at d7 and d11 in comparison with d3, at d15 (35.48) in comparison with d7 and d11. Chroma and hue values were higher (P<0.05) at d3 (21.20 and 16.37, respectively) in comparison with d1 (19.90; 15.38); at d7 (23.11; 17.59), d11 (23.04; 17.76) and d15 (23.27; 17.87) in comparison with d3. On the whole, ageing increased brightness and colour intensity and shifted hue in yellow-red shade. Drip losses resulted higher (P<0.05) at d7 (1.62%) in comparison with d3 (1.06%) and at d11 (2.04%) in comparison with d7. WBs decreased, always significantly (P<0.05) through ageing, from 16.17 kg (d1) to 8.89 kg (d15). The most remarkable decrease (-19.14%) occurred between d3 and d7. Moreover, a lowering of the variability was observed. In fact the C.V. showed the highest value at d3 (22.66%) and the lowest at d15 (14.11%). In conclusion, ageing turned out to be a basic step to improve meat tenderness and reduce its variability even in a breed characterized by a low background toughness, like hypertrophied Piemontese. However, in order to optimize the length of ageing, it is essential to know consumer’s ability in perceiving the tenderness improvement.
Shelf life and fatty acid profile of meat from Podolian cattle

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ABSTRACT

Meat shelf life is an important parameter since consumers discriminate against meat cuts that have lost their fresh appearance. Lipid oxidation is one of the primary mechanisms of quality deterioration in meat during display. This study aimed to evaluate the fatty acid profile and the shelf life of Longissimus thoracis et lumborum (LTL) of Podolian young bulls during retail display. The effect of the ageing method on physical and sensory properties of meat was also assessed. Eight 16+18 month old Podolian young bulls were used. LTL was removed from the right carcass side 48 h postmortem, vacuum-packaged and aged for 5 days at 4°C. The same muscle was taken from the left carcass side previously stored for 7 days at 4°C. The same muscle was taken from the left carcass side previously stored for 7 days at 4°C. LTL was sliced (2.5 cm thickness), then placed on a polystyrene tray, wrapped in a polyvinylchloride film and displayed for five days at 2°C under 8 h illumination from cool white fluorescent lights (350 lux). Podolian meat showed a favourable content of PUFA and a beneficial ratio PUFA/SFA which are important from a nutritional point of view. PUFA percentage significantly decreased (from 20.37±1.9 to 13.41±1.9%; P<0.05) whereas MUFA content increased (from 34.41±1.9 to 41.70±1.9%; P<0.05) during display. Lipid oxidation, as indicated by MDA concentration, significantly increased during retail display (from 0.018±0.009 to 0.08±0.009 mg/kg; P<0.001) and was positively correlated (P<0.05) to MUFA percentages. Display time affected muscle colour: redness a* value increased after 1 day of display and subsequently decreased (P<0.05). L (P<0.01) and a* (P<0.001) indexes were negatively correlated to MDA content. The ageing method did not markedly affect colour parameters. LTL aged on the carcass showed higher sensory tenderness scores (P<0.05) than the vacuum aged ones. Neither Warner-Bratzler shear value nor water losses were affected by ageing method. The ageing method did not markedly affect meat quality in relation to shelf life. This result may encourage in employing vacuum packaging in the ageing of primal cuts from Podolian carcasses in order to avoid chilling and technological losses that generally occur using the traditional ageing method.
A rapid new ethanol preparation for early muscle sampling submitted to NIR analysis: preliminary results for cattle and buffalo

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ABSTRACT

Both the traditional storage of meat samples, through chilling, and the cutting of the Longissimus thoracis muscle (LT) interfere with field test operations for meat quality to a great extent. In this study efficient alternatives were investigated through two novel approaches: first ethanol (ETH) was used to store the meat samples; then the Sternum mandibularis (SM) muscle, immediately available, was used to obtain correlated information about the meat quality of the LT muscle. The FT-NIR rapid technique was also used to examine ETH muscle samples; the NIR interferograms were related to several quality traits using the Partial Least Squares method in calibration and in cross-validation modes. A first trial (A; n=24) examined frozen LT muscles, obtained from different categories of cattle, that had previously been cooked, then scored for tenderness by an untrained team and finally examined for Warner Bratzler Shear-force (WBS). The prediction of the panel consensus from WBS laboratory values was fitted with $R^2=0.47$. The FT-NIRS analysis of ETH samples obtained very similar results ($R^2_{cal}=0.64; R^2_{val}=0.44$), an excellent value considering that it is not necessary to prepare the sample and transport facilities are very easy. The NIR Spectra did not appear to be linked to the WBS laboratory values ($R^2_{cal}=0.12; R^2_{val}=0.05$), suggesting different approaches to fit WBS (quadratic shape) or NIR spectra for the consensus of the panellists. Trial B (n=20) was related to the NIR spectra of small SM cylinders plunged into ETH, with the LT quality of young buffaloes, experimentally fed hay or corn silage. The chemometrics of FT-NIR clearly distinguished the feeding treatment ($R^2_{val}=0.48$) and was significantly related to: MFI<sub>168h</sub> (0.81), raw-WBS (0.68), cooked-WBS (0.44), myoglobin (0.66), pH<sub>96h</sub> (0.56), intramuscular fat (0.50), some PFAs (C<sub>22</sub>_5n3: 0.52; C<sub>20</sub>_2n6: 0.51; C<sub>18</sub>_3n6: 0.44; C<sub>22</sub>_1: 0.35; C<sub>20</sub>_5n3: 0.34), dry matter (0.33), each relationship being significant. The new method of ETH preparation, applied to early muscle cut, then coupled to FT-NIR spectroscopy should be confirmed by further experiments to explore the real capabilities.