Effects of subprimal type, quality grade, and aging time on display color stability and sensory properties of ground beef patties

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Effects of subprimal type, quality grade, and aging time on display color stability and sensory properties of ground beef patties: Project Summary

Background
Display color stability and beef palatability contribute to consumer satisfaction and are economically important factors for the beef industry. Color stability and longer display life without discoloration allows more opportunities for retail sales, fewer discounts and minimal product loss. Palatability factors such as tenderness, juiciness, and flavor contribute to consumer satisfaction and therefore price differentiation of beef products. Ground beef is the most commonly consumed beef product in the United States. Historically, the source of ground beef comes from lower quality cuts, trimmings from subprimals, and subprimals from cull cows. However, alternative grinds from whole and/or premium quality subprimals are becoming more popular with consumers. Subprimals from the chuck and round are logical subprimals that could be used for premium ground beef production as they are lower cost than other subprimals such as from the rib and loin. Ground beef products from higher quality grades such as Premium Choice (upper 2/3s of Choice) offer merchandising potential and are commonly utilized as a higher quality product. The inherent lean and fat property differences that may exist in these subprimals could potentially influence the color display stability and beef palatability properties of their ground beef products.

Subprimals can be stored in a vacuum package for extended periods of time. The number of days that subprimals may be held before processing can be influenced by the distribution chain, accessibility, and subprimal price fluctuations. Extended vacuum storage before grinding could impact biochemical, oxidative, and microbial properties of these subprimals and influence their color stability and sensory properties.

The objective of this study was to determine the effects of two subprimal types (chuck roll and knuckle), two quality grades (Premium Choice and Select), and three vacuum packaged aging times before processing (7, 21, and 42 d) on ground beef patty display color stability and sensory properties.

Methodology
A factorial arrangement of treatments was used to evaluate the effects of two subprimal types (chuck roll and knuckle), two quality grades (Premium Choice and Select), and three vacuum packaged aging times before processing (7, 21, and 42 d) on ground beef patty display color stability and sensory attributes. At the end of each aging time, four knuckles or two chuck rolls, representing their respective quality grade categories, were combined and ground to form a treatment (sample) batch. Six replications were made for each of the 12 treatment combinations. After a final grind, proximate analysis, fatty acid analyses, myoglobin concentrations and pH were conducted on raw uncooked ground beef samples. For display color, patties (113 g) were formed using a patty machine, packaged in PVC-overwrapped trays, and displayed in a coffin-type retail case under continuous fluorescent lighting. Trained color panelists evaluated ground beef patties for visual color and discoloration and a HunterLab MiniScan was used to evaluate instrumental color at 0, 24, 48, and 72 h of display. At 0 and 24 h of display, ground beef patties were evaluated for color stability (oxygen consumption and metmyoglobin reducing ability), microbial (Aerobic plate count), and lipid oxidation (Thiobarbituric Acid Reactive Substances) properties. For sensory panels and instrumental tenderness (slice shear force, textural profile analysis, and Lee-Kramer shear), patties were formed using a patty machine, crust frozen at -40°C before vacuum packaging, stored at -20°C, thawed at 2°C for 24 h, and cooked on a griddle to an internal end point temp of 71°C.
Findings

Chuck roll and Premium Choice subprimals had a brighter red color, less discoloration, and higher L*, a*, b*, and chroma values during display than those from knuckle and Select subprimals, respectively. Using a discoloration score of 5 as the threshold for acceptable color, patties from knuckle subprimals had the shortest display life of slightly less than 24 h, chuck roll subprimals aged for 42 d had a display life of 48 h and chuck roll subprimals aged 7 or 21 d had slightly longer than 72 h of display life. Patties from subprimals aged for 7 and 21 d had higher color stability as indicated by lower oxygen consumption and higher metmyoglobin reducing ability than those aged 42 d. Aerobic plate counts increased with increasing days of aging and were higher at 24 h of display than at 0 h of display. After 24 h of display, patties from Select knuckle subprimals aged for longer periods of time (21 and 42 d) had higher TBAR values approaching a threshold in which consumers may detect an off-flavor. Patties from chuck roll subprimals had more total fatty acids (TFA), greater percentages of saturated fatty acids (SFA), and lower percentages of polyunsaturated fatty acids (PUFA) than those from knuckle subprimals. Patties from Premium Choice subprimals had more TFA, greater percentages of monounsaturated fatty acids (MUFA), and lower percentages of SFA and PUFA than those from Select subprimals. Quality grade and aging time resulted in few differences in sensory panel properties for either the chuck roll or knuckle subprimals. Patties from chuck roll and Premium Choice subprimals and subprimals aged for longer periods of time were tender as measured by instrumental tenderness than those from knuckle and Select subprimals and subprimals aged for fewer days, respectively.

Implications

Subprimal type, quality grade, and aging time can impact display properties of ground beef. Premium Choice chuck rolls aged for fewer than 21 d would be recommended to maximize color stability and extend display life. In contrast, patties from knuckle subprimals should be displayed for a minimal time as color, microbial, and lipid oxidative stability deteriorates rapidly, especially with extended aging times. Subprimal type and quality grade can impact fatty acid profiles of ground beef. Knuckle subprimals offer a lower fat product than chuck roll subprimals and Premium Choice subprimals have higher percentages of fat than Select subprimals, but contain higher percentages of oleic and monounsaturated fatty acids. Subprimal type, quality grade, and aging time can impact some sensory and textural properties of ground beef. However, the mechanical process of grinding may minimize potential property differences.
Tables:
Subprimal type × aging time × display time interaction means for visual color discoloration scores (2 = Bright red; 5 = Moderately dark red; 8 = Tan to brown) of ground beef patties (SE = 0.18)

Photos:

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