„Physische, chemische und Geschmackscharakteristika von Speck"

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Hundert kommerzielle Speckarten, jeweils 20 von fünf auserwählten Ertragsgruppen, wurden analysiert. Der Umfang des Proz. Fleisch für alle Specke rangierte von 16.50 Proz. bis 47.50 Proz., —26.00 Proz. im Durchschnitt. Bedeutende Verhältnisse wurden durch einfache Korrelationen zwischen dem Proz. eigentlichen Fleisches und der geschätzten Ertragsgruppe (r= -.84**), ungeräuchertem Gewicht (r= -.65**) und geräuchertem Gewicht (r= -.78**) angedeutet. Dickemessungen zeigten auch sehr bedeutende Korrelationen, wenn sie mit dem Proz. Fleisch verglichen wurden.* Proz. Durchschnittsverluste durch Kochen stand in einer bedeutenden Beziehung (r=-.61**) zum Proz. Fleisch. Proz. Fett- und Proz. Wasserverluste durch Kochen standen in einer bedeutenden Beziehung (r= -.74** bzw. r= +.65**) zum Proz. Fleisch. Die Regression der Etraggruppe auf Palmiten-, Stearin- und Linolsäuren, auf Proz. Chlorid, Proz. Protein, Proz. Fett und Proz. Wassergehalt wiesen einen hohen Beziehungsgrad auf.(P< .01). Korrelationskoeffizienten zeigten höchst bedeutende Verhältnisse zwischen Proz. Fleisch überhaupt und den chemischen Eigenschaften von: saturierten Fettsäuren (r= -.24**), unsaturierten Fettsäuren (r= +.33**), Proz. Chlorid(r=+.66**), Proz. Protein (r=+.64**), Proz. Fett (r= -.71**) und Proz. Wassergehalt (r= +.44**). Fettlosigkeit, Salzigkeit und Geschmack wurden höchst korreliert mit Proz. Fleisch (+.64, -.58 bzw. +.35). Annehmbarkeit durch Geschmacksproben zeigte r=-.28** für Proz. Saturierten und r= +.23** für Proz. Unsaturierten; Geschmack, mit Proz. Fett (r= -.29**) und mit Proz. Wassergehalt (r= +.27**). Annehmbarkeit verhielt sich positiv zu Geschmack, Salzigkeit und Fettlosigkeit: r= +88**. r= +39** bzw. r= +.60**.

*einzuschalten: Durchschnittlicher Kochverlust war 68.20 Proz., davon 44.92 Proz. Fett und 23.28 Proz. Wassergehalt.

Caractéristiques physiques, chimiques et sensoriaux du bacon.

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Cent bacons commerciaux, 20 chacun de cinq catégories choisies, ont été analysés. L'éventail des pourcentages de viande maigre de tous les bacons allait de 16.50% à 47.56%, avec une moyenne de 26.00%. Des rapports significatifs ont été indiqués par de simples corrélations entre le % de viande maigre et la catégorie estimée (r=-.84**), le poids de viande fraîche (r=-.65**) et le poids de viande fumée (r=-.78**). Les mesures d'épaisseur ont révélé aussi des corrélations très significatives en comparaison avec le pourcentage de viande maigre. La moyenne du pourcentage de perte en cuisson était de 68.20%, composée de 44.92% de gras et 23.28% d'humidité. Le pourcentage total de perte en cuisson avait un rapport significatif (r=-.61**) avec le pourcentage de viande maigre. Le pourcentage de gras et le pourcentage de perte d'humidité en cuisson avaient un rapport significatif (r=-.74** et r=+.65** respectivement) avec le pourcentage de viande maigre. Les rapports de régression des catégories avec les acides palmitiques, stéariques et linoleics, le pourcentage de chloride, de protéine, de gras et d'humidité étaient significatifs. (P<.01). Les coefficients de corrélation ont indiqué des rapports très significatifs entre le pourcentage total de viande maigre et les caractéristiques chimiques de: acides gras saturés (r=-.24**), acides gras non saturés (r=+.33**), % de chloride (r=+.66**), % de protéine (r=+.64**), % de gras (r=-.71**) et % d'humidité (r=+.44**). La maigreur, la salinité et la saveur étaient fortement corrélatives au pourcentage de viande maigre à +.64, -.58 et +.35 respectivement. L'acceptation par le jury de goûteurs indiqua r=-.28** pour le pourcentage de saturés et r=+.23** pour le pourcentage de non saturés; la saveur avec pourcentage de gras (r=-.29**) et avec pourcentage d'humidité (r=+.27**). L'acceptation avait une corrélation positive avec la saveur, la salinité et la maigreur: r=+.88**, r=+.39** and r=+.60** respectivement.

PHYSICAL, CHEMICAL AND SENSORY CHARACTERISTICS OF BACON

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One hundred commercial bacons, 20 each of five selected yield groups, were analyzed. The range of % lean for all bacons was 16.50% to 47.56%, with a mean of 26.00%. Significant relationships were indicated by simple correlations between the % actual lean and the estimated yield group (r=-.84**), green weight (r=-.65**) and smoked weight (r=-.78**). Thickness measurements also revealed highly significant correlations when compared with % lean. Mean % cooking loss was 68.20%, composed of 44.92% fat and 23.28% moisture. Percent total cooking loss was significantly related (r=-.61**) to % lean. Percent fat and % moisture losses in cooking were significantly related (r=-.74** and r=+.65** respectively) with % lean. The regression of yield group on palmitic, stearic and linoleic acids, % chloride, % protein, % fat and % moisture were found to be highly related (P<.01). Correlation coefficients showed highly significant relationships of: percent total lean and the chemical characteristics of: saturated fatty acids (r=-.24**), unsaturated fatty acids (r=+.33**), % chloride (r=+.66**), % protein (r=+.64**), % fat (r=-.71**) and % moisture (r=+.44**). Leanness, saltiness and flavor were highly correlated to % lean at +.64, -.58 and +.35 respectively. Acceptability by taste panel indicated r=-.28** for % saturates and r=+.23** for % unsaturates; flavor with % fat (r=-.29**) and with % moisture (r=+.27**). Acceptability correlated positively with flavor, saltiness and leanness: r=+.88**, r=+.39** and r=+.60** respectively.

Физические, химические и чувствительные свойства бекона

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Абстракт

Пять выбранных приносящих групп бекона — двадцать штук из каждой группы — было анализировано, всего сто штук. Нежирное содержание было из 16,50 процентов до 47,56 процентов; среднее было 26,00 процентов. Значимые взаимосвязи были указаны простыми корреляциями между действительным нежирным содержанием и предполагаемым проносящей группы ($r=-0,84^{**}$), весом до копчения ($r=-0,65^{**}$) и весом после копчения ($r=-0,78^{**}$). Измерения толщины тоже доказали очень значимые взаимосвязи при сравнении с нежирным содержанием. Средняя утрата при жаренье была 68,20 процентов, т.е., 44,92 процента утраты жира и 23,28 процента утраты влаги. Общая утрата при жаренье указала значимую взаимосвязь с нежирным содержанием ($r=-0,61^{**}$). Нежирное содержание указала значимую взаимосвязь с утратой жира ($r=-0,74^{**}$) и влаги ($r=+0,65^{**}$). Регрессы групп по пальмитиновой, стеариновой и линолеиновой кислотам, содержанию хлорида, протеина, жира и влаги были очень значимо связанны. ($P<0,01$). Коэффициенты корреляции доказали очень значимые связи между нежирным содержанием и следующими химическими свойствами: сатуированными жирными кислотами ($r=-0,24^{**}$), несатуированными жирными кислотами ($r=+0,33^{**}$), содержанием хлорида ($r=+0,66^{**}$), протеином ($r=+0,64^{**}$),

содержанием жира ($r=-0,71^{**}$),и содержанием влаги ($r=+0,44^{**}$). Нежирное содержание имело значимые взаимосвязи с восприятием нежирного качества ($+0,64$), солености ($-0,58$) и вкуса ($=0,35$). Мнения о приемлемости людей, которые попробовали бекон, имели взаимосязи с содержанием сатуированных ($r=-0,28^{**}$) и несатуированных ($r=+0,23^{**}$) жирных кислот; мнения о вкусе указали взаимосвязи с жирным содержанием ($r=-0,29^{**}$) и с содержанием влаги ($r=+0,27^{**}$). Приемлемость указала положительные взаимсвязи со вкусом ($r=+0,88^{**}$), с соленостью ($r=+0,39^{**}$) и с восприятием нежирного качества ($r=+0,60^{**}$).

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Introduction

In the United States of America pork production represents over \$4,500,000,000 in farm income and nearly double that amount in retail meat value. This is approximately 10% of the income from all U.S. farm products. The U.S. annual per capita consumption of pork is about 29.5 kg or 35% of the U.S. red meat consumed. Pork bellies comprise 12-15% of the chilled carcass weight and represent 15-17% of the total carcass value. The resulting bacon from these fresh pork bellies is considered to be the single most popular meat item in the U.S. family diet. It is a traditional breakfast meat and popular as a sandwich item. However, very little research has been conducted on the quality and yield aspects of bacon.

Although federal grades for pork do exist in the United States they are seldom applied officially because so little commercial trading is conducted on intact pork carcasses and because of the minor quality variations that do exist or are commercially recognized. Additionally, with a high percentage (70%) of the pork carcass being processed, quality and fresh palatability differences are masked by the processing.

Nonetheless, in the marketplace, and especially for consumer selection criteria, there is a need for some official delineation of quality and quantity differences among pork products in both the fresh and processed form. This, in turn, could result in improved pricing based on true value. Packaging regulations in the U.S., for example, now require that at least 70% of a representative bacon slice be displayed in the container so that the consumer may more accurately evaluate the product.

Research Methods

A study was undertaken in conjunction with the U.S. Department of Agriculture, Agricultural Marketing Research Institute, to attempt to identify the characteristics and properties that could best classify bacon into logical categories or grades. One hundred fresh bellies were selected on the basis of potential yield, into each of five categories, ranging from "ones" (heavily-muscled, high proportion lean) to "fives" (wastey, extremely fat). There were twenty fresh bellies selected for each of the five yield groups. Following curing and smoking by standard commercial practices the bacons were analyzed for both quantitative and qualitative characteristics. The quantitative factors measured included dimensions of thickness, width, length and volume in both fresh and processed condition. Lean and fat percentages were determined by tracing ten slices per bacon slab and calculating the actual lean area with a compensating polar planimeter. The within bacon variation was also determined at the ten sampling sites.

The qualitative factors measured were based on representative samples from each bacon analyzed for fatty acid content by gas chromatography and melting point, protein, fat, moisture and chloride. Additionally, cooking losses were measured by broiling representative slices from each bacon and further partitioning these losses into fat loss and moisture loss. Sensory evaluation of the product was conducted to determine consumer preference by leanness, flavor, saltiness and overall acceptability.

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Research Results

Physical Measurements:

The average fresh belly measurements were $5.42 \pm .28$ kg weight, $55.83 \pm .15$ cm length and $2.95 \pm .03$ cm thickness at the flank end. The yield group "ones" had mean values of $3.87 \pm .21$ kg, $53.11 \pm .24$ cm, $27.51 \pm .13$ cm and $2.21 \pm .03$ cm as compared to $7.03 \pm .39$ kg, $57.27 \pm .41$ cm, $29.92 \pm .18$ cm and $3.68 \pm .05$ cm for the yield group "fives" for these same measurements indicating a definite distinction in weight, length, width and thickness between these two extreme groups. Regression coefficients were significant ($P<.01$) and negatively associated with percentage lean for all objective measurements. Thickness had the most highly significant regression coefficient ($b=-12.72**$) indicating a slight increase in thickness had a highly significant influence on percentage lean. Coefficients of determination indicated that these linear measurements accounted for a high proportion of the total variation in the percentage lean content.

The mean percentage lean for all bacons was $26.00 \pm .43\%$. The within variation ranged from a low of $21.8 \pm 0.49\%$ lean at the center of the bacon to $30.0 \pm 0.47\%$ lean at the blade or shoulder end.

Cooking Losses:

Total cooking loss for the 100 bacons averaged 68.2%, ranging from 60.0 to 75.0%. About two-thirds of the total cooking loss (actually 65.8%) was attributed to fat loss on the average and the remaining one-third loss (actually 34.2%) was due to moisture evaporation during cooking. Leaner bacons lost less fat but more moisture whereas fatter bacons had greater fat loss with less moisture shrinkage. Length and width of the individual bacon slices decreased about one-third (actually 34.7%) in dimension when broiled.

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Fatty Acid Analysis:

Total saturated fatty acids averaged 39.5% (range 34.1 to 49.1%) and total unsaturated fatty acids averaged 60.1% (range 49.9 to 65.4%). The fatter bacons possessed the higher percent saturates and thus the lower percent of unsaturates. Palmitic ($C16:0$) and stearic ($C18:0$) acids were the predominant saturated fatty acids and oleic ($C18:1$) and linoleic ($C18:2$) were the major unsaturates measured.

Melting Point:

The average melting point of fat on all bacons ranged from $37.3^{\circ}C$ to $40.7^{\circ}C$ with a mean of $38.9^{\circ}C$. The leaner bacons had the lower melting points, associated with higher percent unsaturated fatty acids.

Proximate Analysis:

The mean protein analysis of all bacons was 8.3% (range 3 to 12%) with the leaner bacons having the higher protein content. The total fat analysis was 66% (range 40 to 80%) with the leaner bacons having the lower fat composition. Moisture content for all bacons averaged 23% (range 13.5 to 34.8%) with the leaner bacon possessing the higher percent moisture.

Chloride Content:

Chloride content, as an indicator of saltiness in these bacons, demonstrated a mean of 1.68% with a range of 0.78 to 3.75%. Lean or muscle appeared to have a greater affinity for salt than did the fat, both as a physical entity within a bacon as well as when comparing fatter with leaner bacons as a group. Percent chloride with percent total lean had a coefficient of determination of 44% indicating that leaner bacons did absorb more salt than fatter bacons.

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Sensory Evaluation:

The yield group V bacons, which were the fattest bacons, were least desirable according to the taste panel. There was evidence of discrimination against these fatter bacons from both a flavor and overall acceptability basis. The leaner bacons were scored less desirable from a saltiness standpoint which was substantiated by the higher salt percentage determined by chloride content. Each unit change in flavor was associated with 1.34 units change in acceptability demonstrating that most of the variability in organoleptic acceptability of bacon was due to flavor.

Conclusions

Leaner, more desirable bacons may be reliably selected on the basis of thickness and/or weight. From this study it would appear that bacon contains about 26% lean ranging from approximately 21 to 30% in lean content.

Cooking (broiling) losses in these bacons averaged approximately 68%, ranging from 60 to 75%. These losses were attributed to fat (66% approximately) and moisture (34% approximately). Dimensional changes were about 35% shrinkage in width and length from broiling.

The predominant saturated fatty acids present in bacon were palmitic and stearic while the major unsaturates were oleic and linoleic acids. The leaner bacons had the higher percent of unsaturated fatty acids.

The melting point of bacon fat was $38.9^{\circ}C$ (range $37.3^{\circ}C$ to $40.7^{\circ}C$) and the leaner bacons had the lower melting points.

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The bacons studied analyzed 8.3% protein (range 3 to 12%), 66% fat (range 40 to 80%) and 23% moisture (range 13.5 to 34.8%) and 1.68% chloride (range 0.78 to 3.75%). The leaner bacons had the highest protein, moisture and chloride content and the lowest fat composition.

Sensory evaluation of these bacons indicated a preference for the leaner bacons relative to flavor and overall acceptability with definite discrimination against the fatter bacons for these same characteristics.