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אפיון מדדים אובייקטיביים לקביעת איכות הבשר בבני בקר ממרעה גולן

Evaluation of meat quality traits in pasturing beef cattle by objective measurements

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Abstract

The current climate crisis, coupled with the recent COVID-19 pandemic, underscores the critical need for a consistent and reliable supply of locally produced agricultural products, including animal-based food products. These products are essential for ensuring food security—defined as daily and direct access to food—while maintaining complete traceability throughout the production chain, from farm to table, and adhering to stringent food safety and health standards. Simultaneously, livestock producers face the additional challenge of producing, marketing, and branding high-nutritional-quality meat that not only contributes to human health but also enhances the culinary experience.

Schneider Farm, a longstanding family-owned cattle operation located in the Golan Heights, exemplifies this model. Over recent years, the farm, independently and as part of the Golan Pasture Cooperative, has managed all stages of the local beef production chain, serving as a model for farm-to-table operations. These stages include raising pasture-fed cattle, slaughtering in a monitored abattoir, processing and aging cuts in a specialized facility in Katzrin, and retailing directly to consumers through a butcher shop created in collaboration with the “Moshbutz” restaurant, as well as through butcher shops nationwide. The cattle are raised in accordance with the “Healthy Livestock” certification protocol (a standard for high-quality animal-based food),

maintaining principles of transparency and traceability throughout the production chain.

Currently, the primary factor determining beef prices in Israel is kosher certification, with no premiums awarded to producers for meat quality or added value. This significantly undermines the economic viability of cattle farming. To establish a system that incorporates meat quality parameters into producer compensation and simultaneously promotes the profitability of cattle farming, while addressing consumer demand for high-quality, health-promoting meat, it is imperative to standardize, as is common in leading countries, the parameters defining meat quality and health throughout the production chain.

At present, Schneider Farm classifies beef cuts based on a single parameter: marbling (an indicator of juiciness), subjectively assessed via visual evaluation of fat thickness at the intersection of the sirloin and tenderloin (tenderloin head). Within the scope of this research proposal, we aim to standardize several key meat quality attributes—pH, color, marbling, tenderness, and texture—using instrumental and sensory methods on beef cuts (ribeye, top round, and rump) from heifers, steers, and cows raised at Schneider Farm according to the "Healthy Livestock" certification protocol. This standardization will emphasize organoleptic (sensory) parameters such as tenderness, texture, and juiciness.

The findings of this study will provide validated, objective metrics for assessing the quality of the Schneider Farm brand, produced from Golan pasture-raised cattle under the "Healthy Livestock" certification. This could serve as a model for other cattle farms, including dairy farms and sheep operations, aiming to incorporate and promote meat quality standards in their regions. In the dairy sector, responsible for approximately 30% of the annual fresh beef supply in Israel (male calves reared for fattening, culled mature cows, and heifers unsuitable as breeding stock), this model, once established, could also be adapted for farms relying on dairy-derived animals as a beef source.

*Due to the warfare events of the past 14 months, the research could not be conducted as planned, primarily because access to the research site in Katzrin was restricted due to labor shortages and staff deployment from Schneider Farm. Consequently, Task 2,

which involved sensory characterization and taste tests, was not implemented as intended, with the number of cuts characterized being significantly lower than anticipated. These cuts were analyzed in collaboration with Yohai Schneider.

Research Objectives:

1. To establish objective standards (via existing instrumental methods) for beef quality parameters—tenderness, texture, marbling, pH, and color—in ribeye, top round, and rump cuts from heifers, mature cows, and steers raised according to the "Healthy Livestock" protocol.
2. To conduct sensory characterization (via taste tests) of organoleptic parameters such as tenderness, texture, and juiciness in ribeye, top round, and rump cuts from animals outlined in Objective 1, and to correlate these findings with the instrumental assessments to achieve alignment between the two methods.
3. To perform a comparative evaluation of the current subjective (visual) classification of marbling against the chemical determination of intramuscular fat content in ribeye, top round, and rump cuts from heifers, mature cows, and steers.

A preliminary pilot study was conducted to objectively define a series of key beef quality metrics, including tenderness (via shear force analysis), marbling, pH, color, water holding capacity, sarcomere length, and chemical composition (moisture, protein, fat, ash). The study utilized ribeye cuts sampled from the *longissimus dorsi* muscle of mature cows (n=5, mean age 5.5 years) and heifers (n=4, mean age 1.8 years) of mixed local breeds, raised under identical environmental conditions. The effects of the aging process (14 days) on meat tenderness and sarcomere length were also assessed. Slaughter was conducted at the "Melech HaBasar" abattoir in Yarka, following Schneider Farm's routine food production chain. Preliminary pH, color, and visual marbling evaluations were performed on the processing line at the abattoir.

Additionally, ribeye, top round, and flank cuts were collected from six steers and one heifer (total n=7 animals; 21 cuts) at Schneider Farm for the current study. Approximately 72 hours after the cuts were transported from the abattoir to the

processing facility in Katzrin, subjective quality grading was performed by Yohai Schneider through visual evaluation of fat thickness at the intersection of the sirloin and tenderloin (tenderloin head). Subsequently, the ribeye, top round, and flank cuts were selected from each carcass (right hindquarter), and pH, temperature, and muscle and fat color were monitored to examine correlations with the subjective grading metric. The strongest correlation ($R^2=0.99$) was observed between the subjective grading metric determined by the producer (Yohai Schneider) and the a^* value (redness indicator) of the ribeye fat cap ($P=0.0008$). This metric reflects the red-cherry hue of the muscle (and fat cap) and its correlation with muscle iron content (oxygen-carrying capacity). Positive correlations were also found between the a^* value of top round cuts ($R^2=0.72$) and ribeye cuts ($R^2=0.61$) and the subjective grading metric, though these correlations were not statistically significant, likely due to the small sample size. An additional important inverse correlation was identified between carcass pH, measured 72 hours post-slaughter, and the subjective grading metric. This inverse relationship indicates that lower carcass pH 72 hours post-slaughter corresponds to higher subjective grading scores.

In summary, the strong positive correlation observed between the a^* value of sirloin fat color, indicating the intensity of the reddish hue, and the subjective grading index based on the visual assessment of fat thickness at the intersection of the sirloin and tenderloin (tenderloin head), suggests that the latter, which relies on the extensive experience of the farmer (Yochai Schneider), may continue to serve as a subjective quality parameter in the absence of available objective measures in the field. However, it is important to note that expanding the sample size is necessary to further validate this finding. Additionally, incorporating additional objective parameters, as outlined in the original research plan prior to the events of Operation Iron Swords, is recommended.