MEAT QUALITY CHARACTERISTICS OF HOLSTEIN CATTLE: THE STORY OF DAIRY BEEF

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I. INTRODUCTION

In Israel, ~60% of the sources of fresh beef come from the import of live animals. To encourage more sustainable beef production, sound arguments should be presented for stakeholders and policy makers, to control the portion of imported animals. Since free-range beef animals in Israel constitute only a small fraction of the fresh meat production chain, and due to space limitation, which can hardly exceed its current capacity, the vast majority of fresh meat supply could originate from fattened male calves and culled cows from local dairy farms. As in many other countries, the Holstein breed constitute a significant portion of the beef production chain, although primarily being selected for milk production [1]. Aiming to lay the foundations for sustainable beef production system in Israel, the current study evaluated the comparative potential of local Holstein and imported mixed Australian male calves *(Bos indicus* X *Bos taurus)* to produce qualitative fresh meat.

II. MATERIALS AND METHODS

Detailed description of the experimental design can be found in our previous study [2]. Briefly, production traits and meat quality characteristics of Israeli Holstein (N = 205) were compared to those of Australian male calves (N = 169). Individual records of live body weight at slaughter and carcass weight were provided in real time. *Longissimus dorsi et lumborum (LL)* muscle was taken off the left half-carcass of each animal, and delivered to the laboratory for phenotyping of meat quality characteristics [2]. All statistical comparisons were conducted using SPSS software (v21.0). All variables that met our assumptions of normality were compared among breeds using a one-way ANOVA, followed by a Bonferroni multiple comparison test ($P< 0.05$) as described [2].

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III. RESULTS AND DISCUSSION

Dressing percentage (DP) of the Australian calves was higher (57.5±2.1%; $P\leq0.0001$) in comparison with Holstein animals (54.5±2.2%). Indeed, crosses of beef X beef or beef X dairy animals are expected to produce heterogeneous progeny with higher growth rates and DP compared to dairy-bred cattle [3]. On the other hand, dairy-selected animals are known for their higher proportions of non-carcass parts, resulting from their engagement in the process of milk production. The local animals were characterized by superior meat quality (Figure 1). Tenderness, evaluated by Instron apparatus, was significantly higher in the meat of Holstein calves, as judged by the lower SF values (41.5±9.7N) comparing to Australian calves (46.5±9.3N; $P\leq0.0001$). Differences in meat tenderness among *Bos taurus* and *Bos indicus* breeds, with the advantage held by the former, mostly stems from genetic variations in the gene encoding the calpastatin proteolytic enzyme, which is found in association with the rate and extent of muscle proteolysis postmortem [4]. Sarcomere length, often used as a post-rigor indicator representing a positive association with meat tenderness, differed significantly ($P\leq0.0001$) between the two breeds (Figure 1). Specifically, longer sarcomeres were measured in the muscles of Holstein (2.14 ± 0.29 µM), compared to the Australian calves (1.98 ± 0.32 µM; $P\leq0.0001$). Inter-breed differences in IMF were also demonstrated. Here, the *LL* muscles of Holstein calves exhibited higher IMF content (2.80±1.00%) than those of their Australian counterparts (2.51±0.80%; $P\leq0.01$). Such

positive effects of IMF, may rank the local breed in an advantageous position to satisfy consumers' sensory choices. Within the fatty acids profile, the proportion of PUFA were significantly higher in the *LL* muscle of the Holstein calves (7.8±0.02%) comparing to their counterparts (6.6±0.02%; $P \leq 0.0001$). PUFAs are known to possess various health properties, and to act as modulators of different transcription factors, providing, at least partially, the metabolic link between dietary PUFA intake, health, and the progression of chronic diseases. However, taking into account the health-promoting capacity of PUFA and the deleterious dietary potential of saturated FA (SFA), it is suggested that the desired ratio of PUFA to SFA should exceed 0.4, while in some meats, it is around 0.1. Likewise, the PUFA-to-SFA ratio reported herein highlights the superiority of local Holstein (0.170±0.06) over imported Australian meat (0.135±0.05; $P \leq 0.0001$) in terms of meat health index.

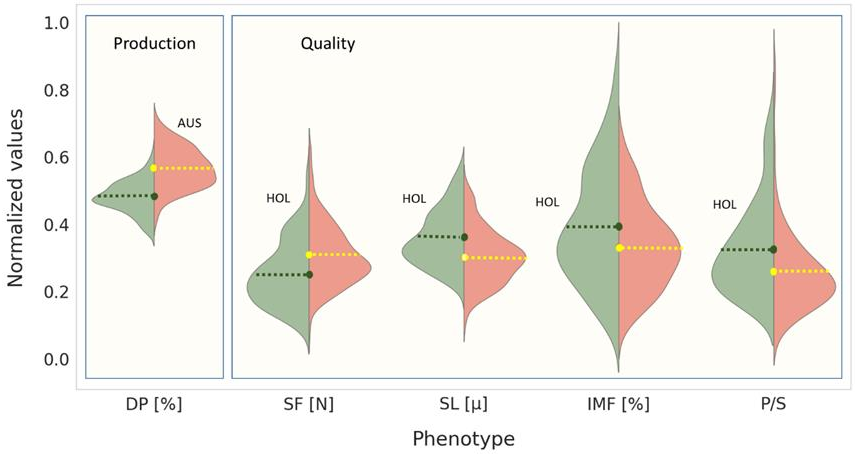

Figure 1. An illustrative violin plot of production (dressing percentage; DP) and meat quality characteristics (shear force, SF; sarcomere length, SL; intra-muscular fat content, IMF; polyunsaturated-to-saturated fatty acid ratio, P/S), comparatively evaluated in Holstein (green; HOL) and Australian (pink; AUS) male calves. The values of each trait are normalized [0,1]. Dark green and yellow dots with dashed lines indicate the mean value of each variable, for Holstein and Australian plots, respectively. The two box plots outlined in blue differentiate between the advantages in production of AUS (left) and meat quality of HOL (right) characteristics.

IV. CONCLUSION

The findings presented here indicate superior meat quality characteristics of the local Holstein cattle over imported Australian calves. Thus, by providing sound arguments for stakeholders and policy makers, these findings may lay the foundation for promoting sustainable beef production in Israel.

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