EFFECT OF MUSCLE FIBRE/FIBRE-BUNDLE ALIGNMENT ON JERKY SOFTNESS

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Introduction

Jerky consumption is rising due to consumer awareness of the importance of low-carbohydrate diets. Traditional jerky is hard to chew thereby limiting its appeal to the growing number of meat snack consumers. Farouk and Swan (1998) reported a two-step process of making soft jerky and recently Farouk et al. (2005) found consumers prefer the appearance of raw beef steaks with muscle fibres running parallel to the cut steak surface compared to steak with fibres running perpendicular, although in the cooked state, the latter steaks were more tender and had better texture. This study was designed to determine the effect of muscle fibre/bundle alignment on the physical and sensory attributes of soft jerky.

Methods

Semimembranosus were sliced into slabs (70 x 70 mm square and 4 mm thick) with the fibres aligned parallel (PR) or perpendicular (PP) to the cut slab surface and used in the manufacture of soft jerky using a two-step drying process (Farouk and Swan, 1999). Physical attributes of the jerky were determined as described in Farouk and Swan (1999). A Texture Analyser (Stable Micro Systems, Godalming, England) with a 100 kg load cell was used to determine the tensile strength of twenty 1-cm wide x 7-cm long strips of jerky per sample. The texture analyzer was equipped with a tensile grip that was used to hold the jerky strips for testing. Each strip was nicked (1.5mm) on both sides in the centre for uniform failure. The testing took place at room temperature (~ 20ºC). Test speed was 2.50 mm/s with a rupture distance of 40 mm. Peak force (Kg-force) and the distance (mm) at peak force were recorded. An in-house expert panel of 8 members assessed jerky colour, tenderness, softness, chewiness and ease of bite on a 9-point scale: 1 = dark red, extremely tough, firm, chewey and hard to pull apart; 9 = bright red, extremely tender, soft, easy to chew and easy to pull apart for colour, tenderness, softness, chewiness and ease of biting respectively. Data were analysed using Genstat (2005) statistical software package.

Results and discussion

There were no differences in pH, total moisture loss (thaw drip + cook loss), shearforce or compressive strength in the raw meat used for making the jerky samples (data not shown). The initial and final yield and water activity were higher ($P > 0.05$) in PR jerky relative to PP (Table 1). This is because PP jerky dried faster than PR at all the stages of production. This effect of fibre alignment was previously observed (Farouk et al. 2005).

Table 1. Jerky processing attributes as affected by muscle fibre/bundle alignment

Treatment	Initial yield (%)	Re-hydration (%)	Final yield (%)	Water Activity (A_w)	Tensile strength (Kg-force)
Across	41.2	26.7	32.7	0.71	1.1
Along	45.8	23.4	34.7	0.82	4.5
SED	0.9*	1.7	0.7*	0.01*	0.4***

SED = Standard error of difference; *, ** * = significant at $P < 0.05$ & 0.001 respectively

Table 2. Jerky colour as affected by muscle fibre/bundle alignment

Treatment	CIE colour			Sensory scores
	L*	a*	b*	Redness
Across	35.8	2.5	0.5	1.6
Along	36.2	5.4	1.1	3.6
SED	1.5	0.4**	0.1**	0.6*

SED = standard error of difference; *, ** = significant at $P < 0.05$ & 0.01 respectively

Percent re-hydration (marinade uptake) after initial drying was numerically but not significantly higher (P > 0.05) in PP jerky relative to PR (Table 1). This could be because PP jerky pieces were dryer at the first stage of drying relative to PR. PR jerky were redder (CIE a*, expert panel) and yellower (CIE b*) than PP jerky (Table 2). Expert panellists found PP jerky easier to bite and chew, and these were also more tender and softer than PR jerky (Table 3). Farouk et al. (2005) found restructured steaks prepared with fibres/fibre bundles cut perpendicular to the face of the steak to be more tender relative to the ones with fibres cut parallel. Texture analysis data also indicated that less tensile stress and strain were required to break off a strip of PP jerky relative to PR (Table 1). The reason is that, fibres/fibre bundles in strips of PP jerky were only pulled apart and not cut. In other words the connective tissue peeled off the fibres/fibre bundles rather than being cut. The peeling or separation was along the endomysial connective tissue as shown in Figure 1a. On the other hand more force was required to cut the fibres along or parallel to their grains with the associated connective tissues as seen in PR jerky (Fig. 1b). This difference in the way the connective tissue components and the meat fibres/fibre bundles separates with tensile stress simulates the biting of a piece of jerky by a consumer (Farouk and Swan, 1999) when jerky is prepared from meat slices cut perpendicular/across or parallel/along the grains.

Table 3. Jerky sensory attributes as affected by muscle fibre/bundle alignment

Treatment	Sensory scores			
	Softness	Tenderness	Ease of biting	Ease of chewing
Across	6.2	7.0	7.7	7.3
Along	3.7	3.5	2.8	3.6
SED	0.4***	0.3***	0.3***	0.4***

SED = Standard error of difference; **** * =** significant at P < 0.001 respectively

a **b**

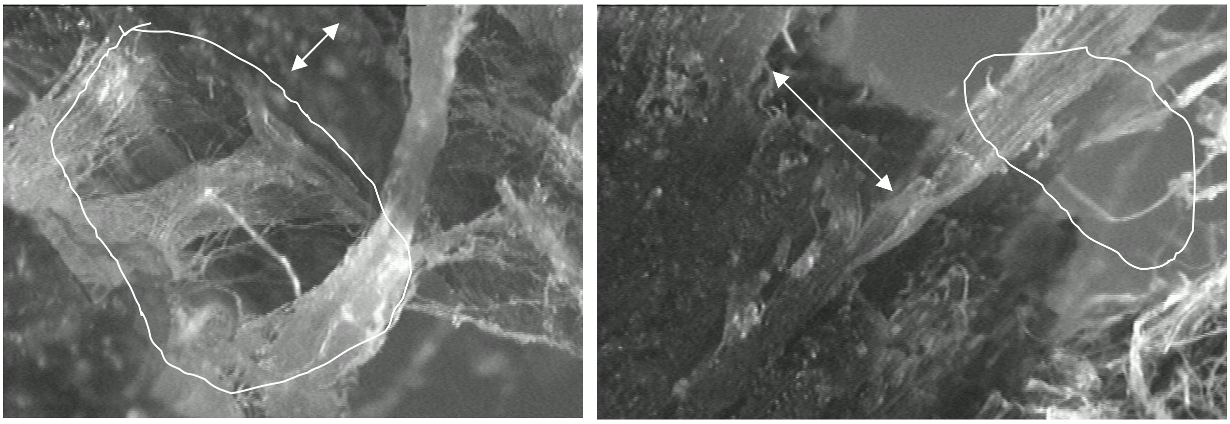

Figure 1 (a-b). Representative micrographs (magnification 82x) of the break point of jerky under tensile stress showing the effect of fibre alignment: across (a) & along (b). Double headed arrows = muscle fibres/bundles; free form circle = circled connective tissues affected in jerky breakage under tension stress.

Conclusion

Jerky can be made softer and be dried to a desirable water activity level faster by slicing meat across rather than along the fibre/fibre bundles before drying. This will make a significant difference in the cost of producing jerky as drying contribute significantly to the cost of making jerky. However, the cost benefit analysis of the faster drying and the 2% difference in the final yield of the two jerkies should be considered before any conclusion is made on the cost benefit of one of the process against the other. For traditional kind of jerky where toughness and chewiness are desirable, slicing the jerky meat slices along the grains rather than across will provide a product with a better eye appeal.

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References

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