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The accuracy of Video Image Analysis (VIA) and Optical Fibre Diameter Analysis (OFDA) to measure fibre diameter of cashmere

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Abstract

The aim of this study was to evaluate two techniques, Optical Fibre Diameter Analysis (OFDA) and Video Image Analysis (VIA) that were used to measure fibre diameter of cashmere and guard hair produced by South African indigenous goats. The fibre measured by the OFDA technique was less fine than that measured by the VIA technique. The findings of this study suggests that more precise results are obtained with the VIA technique than with the use the OFDA method of measuring fibre diameter.

Keywords: VIA, OFDA, cashmere, diameter
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Introduction

South Africa has a potential market for its unexploited cashmere hair. Extra income can be generated if the entrepreneur processes cashmere fibre into products. An accurate technique is needed to quantify the quality of cashmere in terms of fibre diameter which will provide opportunities for creating employment in rural areas. With the Optical Fibre Diameter Analysis (OFDA) technique a minimum sample of 3 g is required for the analysis of clean cashmere yield and fibre diameter. With the Video Image Analysis (VIA) technique a sample of any size can be analyzed. The OFDA is available in the portable form that makes it easy for use in the field when immediate results are required. The VIA can be used in the laboratory when accurate and precise results are required. According to Stanford *et al*. (1998) the VIA technique shows potential as an objective, accurate and cost-effective method.

Materials and Methods

Cashmere collected from different production areas in Gauteng (Irene, University of Pretoria and Roodeplaat) and Limpopo (Delftzyl and Mara) Provinces of South Africa, was spread out on a black velvet-working surface. A representative sample was placed into a glass tube using a pair of tweezers. The sample was washed twice with ether and dried using filter paper. The sample was cut into small pieces using scissors. It was then mounted on a glass slide and covered with a small plastic top slide. The slides were left for a few days to dry. These slides were viewed with a Video Image Analyzer at 40 X enlargement for fibre diameter analysis. Using a computer mouse pointer, the longitudinal sides of the hair were selected and the computer would calculate the distance between the sides along the fibre length. A computerized calculation determine minimum and maximum fibre diameter, mean value, sum of all measurements, the variance and the standard deviation (Snyman, H., 2001, personal comm., ANPI-ARC, Irene, Pretoria).

The remaining portion of the samples was sent to the CSIR, Division of Textile Technology, in Port Elizabeth, South Africa, to determine fibre diameter by means of the completely automated OFDA-method. The samples were mixed thoroughly by hand and a 50 g sub-sample was taken. The sample was minicored using the pneumatic minicore sampler. Thereafter, the fibre snippets were spread over a slide and 3000 measurements per sample were made automatically by the computer. In this method the cashmere and guard hair diameters were measured simultaneously, but were separated into two parameters, fibre diameter and fibre diameter distribution, which were previously programmed into the computer (Hermann & Wortmann, 1996). The relationship between the OFDA and VIA was determined by using the Proc GLM procedure of SAS (1994). Significance of difference between least square means was determined by the Fischer Test (Samuels, 1989).

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Results and Discussion

The variation in fibre diameter of guard hair from different areas, using the two techniques is presented in Table 1. The differences in cashmere diameter from different locations, using the two techniques, are presented in Table 2.

Table 1 The influence of location on guard hair diameter of indigenous goats using the Video Image Analysis (VIA) and Optical Fibre Diameter Analysis (OFDA) measuring techniques

Area	Diameter (µm) by VIA	Diameter (µm) by OFDA
Irene	69^{a} (± 3.61)	89^{a} (± 5.72)
University of Pretoria	58^{b} (± 2.68)	89^{a} (± 4.57)
Roodeplaat	62^{b} (± 2.91)	95^{a} (± 4.76)
Delftzyl	60^{b} (± 2.86)	89^{a} (± 5.71)
Mara	60^{b} (± 3.14)	85^{a} (± 5.32)

^{ab}Column means with common superscripts do not differ significantly (P > 0.05); (±) - Standard deviation

Table 2 The influence of location on cashmere diameter of indigenous goats using the Video Image Analysis (VIA) and Optical Fibre Diameter Analysis (OFDA) techniques

Area	Diameter (µm) by VIA	Diameter (µm) by OFDA
Irene	12^{a} (± 0.32)	17^{a} (± 0.95)
University of Pretoria	10^{b} (± 0.24)	14^{bc} (± 0.76)
Roodeplaat	9^{c} (± 0.26)	14^{bc} (± 0.79)
Delftzyl	9^{c} (± 0.26)	15^{bc} (± 0.95)
Mara	10^{b} (± 0.28)	15^{ac} (± 0.89)

^{abc}Column means with common superscripts do not differ significantly (P > 0.05); (±) - Standard deviation

The guard hair diameter and cashmere diameter measured by the OFDA were on average 27 µm and 5 µm coarser, respectively, than those measured by the VIA technique. The regression coefficient between the OFDA and VIA techniques was low (for cashmere and guard hair, 27.1 and 16.0, respectively). Several inaccuracies could have been present in the OFDA method. One potential problem is that the computer is calibrated to decide which fibres should be classified as cashmere and which as guard hair. This is based on predetermined criteria for fibre diameter and fibre diameter distribution. This does not allow any leeway, so that there could be fibres between which the computer could not differentiate, and they would probably be ignored. It is also possible that the pre-determined parameters set on the OFDA might record finer guard hairs as cashmere. This would result in an incorrect description of the composition of the fleece (Baxter *et al.*, 1992). However, with the VIA method 20 measurements of each hair type are made manually. According to this method one would determine in which category the hair falls and will determine the difference between cashmere and guard hair. Therefore, the VIA method is probably producing the most accurate data.

Conclusion

The fibre diameter measured by the VIA was finer than that measured by the OFDA technique. These results suggest that more precise values are obtained with the VIA technique.

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