Effect of the inclusion of citrus pulp in the diet of goats on cheeses characteristics

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Abstract

The differences between the physicochemical (water content, water activity, pH, NaCl, fat, color, and texture) and sensory (descriptive analysis and consumer test) characteristics of cheeses made from the milk of goats fed on a typical control diet and goats fed on a diet incorporating orange pulp were compared. The addition of orange pulp leads to obtain cheeses (i) with a lower pH and water activity, but with a higher fat content, (ii) that are lighter and with a more yellowish-green hue and (iii) higher in color purity, hardness and adhesiveness, although they are less elastic and cohesive. Thus, the incorporation of orange pulp into the goat's diet affected not only the presence of holes in the cheese, but also its hardness, goat taste and salty taste, which were associated with a higher score of consumer acceptance.

Key words: Goat, diet, cheese, orange pulp, physicochemical properties, sensory analysis

Highlight

⏩The addition of orange pulp to the diet affect physicochemical cheese properties. ⏩The evolution of properties with the ripening time was similar to the control cheese. ⏩Chesses obtained with the orange pulp diet present a higher level of consumer acceptance and a greater intention of purchase. ⏩The use of milk of goats fed with the orange diet improves the sensory quality of the obtained cheeses

1. Introduction

The nutritional needs of animals are met from two major food groups: rich in energy and / or protein concentrates and fibrous foods, mainly forages. It is essential to know the chemical composition of the diet, its nutritional value and the amount in which it can be ingested by goats. Nowadays, because of to the low profitability of the small ruminants sectors, it is very important to reduce the cost of their diet (Garg et al, 2013).

The use of agroindustrial by-products for ruminant feed is an economical and environmentally sound way for food processors to reduce waste discharge and to decrease waste management costs. Historically, the use of agroindustrial by-products in areas where the natural forage is insufficient has been recommended (Martinez and Medina, 1982 Martinez et al, 1998.). Actually, its use seems widespread and covers areas where natural forages are surplus. The choice of agroindustrial by-products supplementation should be based on economical (low price), nutritional (dense in nutrients), and toxicological (free of toxins or other substances) considerations. Large amounts of waste from citrus processing for juice extraction is available in Spain. Citrus pulp, the main citrus by-product, is a high energy content by-product that can partly replace cereal grains in animal rations with no adverse effect on milk yield or composition. The use of citrus pulp in formulated feeds depends largely on the availability and its relative cost-effectiveness when compared with other alternative raw materials. Citrus pulp is primarily a feedstuff with low protein and high carbohydrate contents, which differs substantially from the chemical composition of conventional raw materials. The nutrient content of citrus by-product feedstuff is influenced by different factors, including the source of the fruit and the type of processing. In general, all citrus by-products are suitable for inclusion in ruminant diets because of their ability to ferment high-fiber feeds in the rumen (Arbabi et al., 2008). The effects of incorporating citrus pulp into cow, sheep and goat diets on the physical quality of the milk has been studied (Bampidis and Robinson, 2006; Jaramillo et al., 2006). However, its effect on physico-chemical and sensory characteristics of the obtained dairy products is important (Scholz, 1995; Lebecque et al., 2001) and, to date, it is not available.

The aim of this study was to compare between cheeses made from the milk of goats fed on a conventional diet and on a diet supplemented with orange pulp. The physico-chemical and sensory properties during cheeses ripening were studied.

2. Material and methods

2.1. Samples

24 Murciano Granadina (a Spanish breed) goats, part of the small-ruminant farm of the Universitàt Politècnica de València (UPV), in the sixth month of lactation were adapted to experimental conditions and for 14 days from, were fed on a control diet. Later, the 24 goats were divided into two groups, according to their productive characteristics and the composition of their milk. These two groups followed a 46-day pilot phase, during which the goats were fed on 2 different although nutritionally equivalent diets, the same control diet (CD) used in the pre-experimental period and a diet incorporating orange pulp (OPD). Randomly, one of the groups was fed in the first 23 days on the CD and the other one on the OPD. The diets were changed in the second period. For each animal, both diets contained1500 g of alfalfa and 200 g of straw. In addition, the CD contained 1300 g of feed supplement and the OPD included 100 g of feed supplement, 50 g of soy and 2500 g of orange pulp

per animal. The CD contained: 17 g protein/100 g of dry matter and a net energy of 0.82 fodder units (FU) (Belloin, 1988.). The OPD contained 16.33 g protein/100 g dry matter and a net energy of 0.82 FU units fodder milk/kg dry matter. The components of the diets were supplied by a local company (Piensos y Cereales Noalles S.L., Valencia), and the rations were prepared daily, just before the goats were fed**.**

2.2. Manufacture of the cheeses

The cheeses were prepared in the cheese factory of UPV. The raw milk was obtained at the same day as the cheeses were manufactured. Upon receipt, the milk was filtered and kept in refrigeration until the start of the processing. The process started by the addition of the commercial starter culture (Laboratorios Arroyo, Santander, Spain) when the milk reached the appropriate temperature setting for the bacteria (28 - 30 °C). After that, calcium chloride and the rennet (Laboratorios Arroyo, Santander, Spain) were added in order to initiate the formation of a firm curd. After coagulation (about 35 min), the curd was cut with large knives to allow the elimination of the serum. The curd was placed into moulds and pressed to facilitate the blending of the curd grains and to accelerate the whey separation. After this stage, the cheeses were salted in brine (22 °Baume concentration) to eliminate more whey and to make possible the formation of the cortex. Finally, the cheeses went through a ripening stage of 60 days inside chambers with controlled temperature (11-12 ºC) and relative humidity (80-85). The minimum ripening time was in accordance with the current Spanish regulations for making cheeses made from raw milk, which weight less than 1.5 kg (España, 2006). The final products had an average weight of 800 g. Cheeses made from the milk of goats fed on CD are named CCh and those made from the milk of goats fed on OPD are named OPCh.

2.3. Physico-chemical characterization of cheeses

Cheeses were characterized throughout ripening process in the chambers at 1, 40 and 60 days from the start. The crust was removed when preparing the samples for analysis.

2.3.1. Water content

The water content of the cheeses was measured in triplicate following the official AOAC 926.08 method (1997).

2.3.2. Water activity

The water activity (a_w) of the samples, previously homogenized, was measured in triplicate by using a dew point hygrometer (Decagon Devices Inc, Aqualab 4TE, USA).

2.3.3. pH

The pH was measured using a pH meter (Crison Instruments, S.A., Basic 20, Spain) with a penetration electrode. The readings were taken in different parts of the cheese, making a minimum of six readings per sample.

2.3.4. Sodium chloride

An automatic chloride analyzer (Sherwood Scientific, Chloride Analyzer 926, U.K.) was used to determine the sodium chloride content in the cheeses, following the equipment instructions.

2.3.5. Fat content

The Soxhlet method was used to separate the fat from cheese. It is a little time-consuming and labor intensive method and its validity has been tested by comparing the determinations of fat in cheese products with those analyzed by conventional methods, such as the Roese-Gottlieb, the Gerber, the Schmidt-Bondzynski-Ratzlaff and the Babcock (García-Ayuso et al., 1999; Purcarea, 2009).

2.3.6. Color

Color measurement was done by using a Minolta, CM 3600D (Tokyo, Japan) spectrocolorimeter which provided the CIE-L*a*b* color coordinates (10º observer and D65 illuminant) (Hutchings, 1999). Readings were obtained at room temperature (22±1 ºC) directly on the surface of cylindrical samples, 10 mm in height and 20 mm in diameter. At least 20 replicates were carried out for each sample. In order to quantify the color difference caused by ripening, the ΔE^* was calculated (Eq. 2) between cheeses kept inside the ripening chambers for 1 and 60 days. This equation was also used to quantify the color difference between CCh and OPCh samples ripened for 60 days.

$$\Delta E^* = \sqrt{\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2}} \quad (2)$$

The color difference is graded as follow (Bodart et al., 2008): $\Delta E^* < 1$ color difference could not be detected by the human eye; $1 < \Delta E^* < 3$ minor color differences could be detected by the human eye, depending on the hue, and $\Delta E^* > 3$ color differences would be detected by the human eye.

2.3.7. Textural properties

Texture measurements were performed using a TA-XT Plus Texture Analyzer (Stable Micro Systems, U.K.). A Texture Profile Analysis (TPA) was carried out at room temperature (22±1 ºC) using a 45 mm diameter plunger (P/45). A sample (10 mm in height and 20 mm in diameter) was compressed to 50% of its height at a constant deformation rate of 1 mm s^{-1}, leaving 5 s between the first and the second compressions. At least 20 replicates were carried out for each sample. The parameters obtained from the test were: hardness (maximum force registered during the first compression cycle), adhesiveness (negative area registered after the first compression cycle), cohesiveness (ratio of the positive areas under the first and the second compressions), springiness (height recovered by the sample during the time elapsed between the end of the first compression and the start of the second compression cycles), gumminess (energy required to disintegrate a semi-solid food) (Rosenthal, 1999).

2.4. Sensory analysis

The samples were assessed in a standardized tasting room, which was equipped with individual booths (ISO, 2007). The data acquisition was performed using Compusense five releases 5.0 software (Compusense Inc., Guelph, Ontario, Canada).

2.4.1. <u>Descriptive sensory analysis</u>

Descriptive sensory analysis was carried by a panel of 11 assessors (25-55 years old) with experience in assessing similar products, which were trained for the descriptive sensory analysis (ISO, 2012) to select the descriptors by using a consensual checklist method, as described by Lawless and Heymann (1998). During the training sessions, the assessors proposed a list of sensory attributes for the product, their definitions and how to evaluate each attribute in an open session. This procedure was proposed by Stone and Sidel (2004) in order to obtain a complete description of a product's sensory properties. The panel reached a consensus and the following descriptors were chosen: appearance (presence of holes), goat cheese odor, foreign odor, hardness in mouth, pastiness, goat cheese taste, salty taste, acid taste, fatty taste and foreign taste.

Panel members were trained in the use of scales with reference samples. A 10-cm unstructured scale was used throughout the training period. Panel performance was checked by analysis of variance (ANOVA) for discrimination ability and reproducibility of the panelists using the statistical software Senpaq (V. 4.2). Twelve 30-min training sessions were required for the panel members to reach homogeneous evaluation

The samples were rated in duplicate, in two separate sessions, on a 10-cm unstructured scale. The data was analyzed by using experimental design of balanced complete blocks. The two set of goat cheese samples, CCh and OPCh, were presented to the assessors with randomly assigned three-digit codes in a randomized order on plastic trays at 22 ºC. Each panel member assessed two samples per session. Water was provided to rinse the mouth between each sample.

2.4.2. Consumer test

Eighty two untrained consumers from 18 to 50 years old (30% men and 70% women), which frequently eat goat cheese, took part in the consumer test. The consumers evaluated the two samples (CCh and OPCh), coded with random three-digit numbers following a balanced complete block experimental design. Consumer acceptance testing was carried out using a 9-point hedonic scale (9 = like very much; 1 = dislike very much). The consumers scored their linking for the “appearance”, “color”, “texture”, “taste” and “overall acceptance”.

In addition, the consumers answered to a questioner in which it was asked if they perceived a strange odor or taste with “yes” or “no”. The consumers also evaluated their intention to purchase the cheeses on five-point category scales with the ends anchored with “I would definitely buy it” through to “I would definitely not buy it” and a neutral central point: “maybe I would or maybe I would not buy it.”

2.5. Statistical analysis

A one-way analysis of variance (ANOVA) was used to see if the effect of goat feed on the physico-chemical parameters of cheeses was significant. The least significant differences were calculated by Tukey's test and the significance at $P < 0.05$ was determined using the software Statgraphics Plus (V. 5.1). A two-way analysis of variance (ANOVA) was applied to each descriptor in the descriptive sensory analysis, considering the assessors, the samples and their interaction as factors. A one-way analysis of variance (ANOVA) was applied to the consumer test in order to study the effect of the sample on the consumer acceptability scores. In both analyses, the least significant differences were calculated by Tukey's test and the significance at $P < 0.05$ was determined. Sensory statistical analyses were performed using XLSTAT 2009.4.03 statistical software (Microsoft, Mountain View, CA).

3. Results and discussion

3.1. Physico-chemical characterization of cheese

The two diets did not affect significantly the pH, a_w or fat content of fresh cheeses (Table 1). However, the water and NaCl contents were higher in cheeses newly made from goats fed on OPD. On the whole, as ripening progressed the pH, the NaCl content and the fat content of the two cheeses increased, even when data are compared on dry basis, while water content and a_w decreased. These results coincide with those obtained by Freitas and

Malcata (2000). The increase of pH during ripening may reflect proteolytic processes, which release certain basic amino acids, NH_3 and lactate decomposition (Brito et al., 2003). The decrease in a_w during ripening occurs as a result of increase in solid concentration and due to the production of low molecular weight non-protein nitrogen compounds and soluble solutes derived from glycolysis, proteolysis and lipolysis processes (Marcos et al., 1979). Hence, the addition of orange pulp to the animal diet led to cheeses with lower values of pH and a_w, but with a higher content of both fat and NaCl at the end of the ripening period studied.

3.2. Evaluation of color in cheeses

The obtained color characteristics agree with those reported by Chacón-Villalobos and Pineda-Castro (2009) when analyzing goat cheese under similar conditions. After manufacture, OPCh samples had higher L* and negative a* values and lower values of b* in comparison to CCh samples (Table 2). The higher water content of OPCh might favor the product's lightness (Álvarez et al., 2007; Caro et al., 2014). As far as ripening time was concerned, only a significant increase in b* was found only at 60 days. Similar trends were reported by Rohm and Jaros (1996) and Buffa et al. (2001). According to Lucas et al. (2008), the increase in b* values relates to proteolysis and browning reactions. With respect to the color difference brought about by the ripening stage, this was of 3.8 units (standard deviation 0.4) for CCh samples and of 2.0 units (standard deviation 0.2) for OPCh samples. Only for CCh was this difference greater than 3 units, indicating color changes that may be perceived by the human eye (Bodart et al, 2008). On day 60, the color differences between the two cheeses were in the order of 5.8 units (standard deviation 0.6), indicating that consumers will be able to differentiate between them.

3.3. Texture evaluation of cheese

During ripening, the samples became significantly harder and more adhesive, while the springiness, cohesiveness and gumminess decreased significantly (Table 3). At the end of the ripening stage, OPCh samples exhibited greater hardness and adhesiveness and less springiness, cohesiveness and gumminess, as compared with CCh. In general, these changes are consistent with previous results under similar settings (Lucey et al., 2004, Theophilou and Wilbey, 2007). The increase in adhesiveness and the decrease in springiness may be caused by the rupture of the fat globule membrane. A lower degree of springiness also decreases the resistance to deformation, leading to less cohesiveness (Muller, 1977).

3.4. Sensory analysis of cheeses

The results from the descriptive sensory analysis showed that goat feed had some effects on several descriptors of the cheeses. As can be seen in Fig. 1, panelists only detected significant differences in the descriptors “appearance (presence of holes)”, “hardness in mouth”, “goat cheese taste” and “salty taste”. OPCh had higher values of hardness in mouth, goat cheese taste and salty taste, but lower values of appearance (presence of holes) in comparison with CCh. The higher salty taste, hardness and goat cheese taste that was found in OPCh may be related to the higher content of sodium chloride, higher instrumental hardness and higher fat content obtained for this sample in comparison to CCh. This higher fat content favored the palatability of the product and, therefore, the greater cheese taste found by the panelists. In fact, other authors found less flavor and taste in cheeses with lower fat content (Childs and Drake, 2009; Deegan et al., 2014).

As a complement to the descriptive analysis, a consumer test was carried out to evaluate the acceptance of the cheeses. The liking scores for the “appearance,” “color,” “texture” “taste” and “overall acceptance are shown in Fig. 2. Only taste and overall acceptance were significantly different between the samples being the OPCh scores higher. These results suggest that the most important attribute, which affect the overall sample acceptance, is the taste. When the results were analyzed for the question concerning whether consumers perceived a strange odor or taste in the samples, it was found that 87% and 95% of consumers did not perceive any strange odor in CCh and OPCh, respectively. Nevertheless, 40% of the consumers perceived a certain, strange taste in CCh (bitter, spicy and acidic) and only 20% of the consumers claimed that they detected a mild goat cheese taste. This result may explain the significant differences in consumer acceptance of the taste of the studied samples. Finally, from evaluation of the responses regarding the intention to purchase the samples, it was found that only 39% of the consumers would buy the CCh, while 53% would buy the OPCh.

4. Conclusions

Adding orange pulp to the diet of goats affected some physicochemical properties of the cheeses, although the evolution of these properties with the ripening time was similar in both types of cheese. Cheeses made with the incorporation of orange pulp to the diet had higher level of consumer acceptance and a greater intention of purchase, probably because the consumers perceived greater hardness, more marked salty taste and goat taste. Hence, the use of milk of goats fed with the orange pulp diet improves the sensory quality of the obtained cheeses.

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References

Álvarez., S., Rodríguez, V.,. Ruiz, M. E., Fresno, M. 2007. Correlations between instrumental texture and colour with chemical composition of canarian goat cheeses. Arch. Zootec. 56 (Sup. 1): 663-666.

AOAC. 1997. Rapid determination of moisture/solids and fat in dairy products. Method nº 926.08. Official methods of analysis of AOAC International (16th Ed).

Arbabi, S., Ghoorchi, T., Naserian, A. 2008. The effect of dried citrus pulp, dried beet sugar pulp and wheat straw as silage additives on by-products of orange silage. Asian J. Anim. Sci. 2, 35-42.

Bampidis, V.A., Robinson, P.H. 2006. Citrus by-products as ruminant feeds: a review. Anim. Feed Sci. Technol. 128, 175-217.

Belloin, J. C., 1988. Milk and dairy products: production and processing costs, in: FAO (Ed.), Animal Production and Health Paper 62. FAO, Rome (Italy), 121 p.

Bodart, M., Peñaranda, R., Deneyerc, A, Flamant, G. 2008. Photometry and colorimetry characterization of materials in daylighting evaluation tools. Build Environ. 43, 2046-2058.

Brito, C., Manríquez, X., Molina, L., Pinto, M. 2003. Estudio de maduración de queso Chanco bajo en grasa elaborado con leche homogeneizada. Arch. Latinoam. Nutr. *53,* 299-305.

Buffa, M.N., Trujillo, A.J., Pavia, M., Guamis, B. 2001. Changes in textural, microstructural, and colour characteristics during ripening of cheeses made from raw, pasteurized or high-pressure-treatedgoats' milk. Int. Dairy J. 11, 927–934.

Caro, I., Sergio Soto, S. Lucía Fuentes, L., Néstor Gutiérrez-Méndez, N., García-Islas, B., Monroy-Gayosso, K.E., Mateo, J. 2014. Compositional, functional and sensory characteristics of selected mexican cheeses. Food Nutr. Sci. 5, 366-375.

Chacón-Villalobos, A., Pineda-Castro, M.L. 2009. Características químicas, físicas y sensoriales de un queso de cabra adaptado del tipo “Crottin de Chavignol”. Agron mesoam. 20, 297-309.

Childs, J. L., Drake, M. 2009. Consumer perception of fat reduction in cheese. J. Sens. Stud. 24 (6), 902 – 921.

Deegan, K.C., Holopainen, U., McSweeney, P.H., Alatossava, T., Tuori, H. 2014. Characterisation of the sensory properties and market positioning of novel reduced-fat cheese. Innov. Food Sci. Emerg, Tech. 21, 169-178.

España. 2006. Real Decreto 1113/2006, del 29 de septiembre de 2006 por el que se aprueban las normas de calidad para quesos y quesos fundidos. Boletín Oficial del Estado, 6 de octubre de 2006, núm.239, 34717-34720.

Freitas, C.A., Malcata, F.X. 2000. Microbiology and biochemistry of cheeses with Appe’lation d’Origine Protege’e and manufactured in the Iberian Peninsula from ovine and caprine milks. J. Dairy Sci. 83, 584-602.

García-Ayuso, L.E., Velasco, J., Dobarganes, M.C, Luque De Castro, M.D. 1999. Accelerated extraction of the fat content in cheese using a focused microwave-assisted Soxhlet device. J. Agric. Food Chem. 47, 2308-2315.

Garg, M.R., Sherasia, P.L., Bhanderi, B.M., Phondba, B.T., Shelke, S.K., Makkar, H.P.S. 2013. Effects of feeding nutritionally balanced rations on animal productivity, feed conversion efficiency, feed nitrogen use efficiency, rumen microbial protein supply, parasitic load, immunity and enteric methane emissions of milking animals under field conditions. Anim. Feed Sci. Technol. 179, 24-35.

Hutchings, J., 1999. Food Color and Appearance. Aspen Publishers, Inc., Gaithersburg, Maryland.

ISO. 2007. Sensory analysis: General guidance for design of test rooms. Standard no.8589. Geneva, Switzerland.

ISO. 2012. Sensory analysis: General guidance for the selection, training and monitoring of selected assessors and expert sensory assessors. Standard no.8586. Geneva, Switzerland.

Jaramillo, D., García, T., Guamis, B., Rodríguez, M., Trujillo, A.J. 2006. Effect of the inclusion of citrus surplus in the diet of lactating ewes on the cheesemaking properties of milk. Sustainability of the agri-food chain. Effost Annual Meeting. The Hague, The Netherlands.

Lawless, H., Heymann, H. 1998. Sensory Evaluation of Food: Principles and Practices. Chapman & Hall, NewYork, NY.

Lebecque, A., Laguet, A., Devaux, M.F., Dufour, E. 2001. Delineation of the texture of Salers cheese by sensory analysis and physical methods. Lait. 81, 609-623.

Lucas, A., Rock, E., Agabriel, C., Chilliard, Y., Coulon, J.B. 2008. Relationships between animal species (cow versus goat) and some nutritional constituents in raw milk farmhouse cheeses. Small Ruminant Res. 74, 243-248.

Lucey, J.A., Johnson, M.E., Horne, D.S. 2003. Invited Review: Perspectives on the basis of the rheology and texture properties of cheese. J. Dairy Sci. 56, 2725-2743.

Marcos, A., León, F., Fernández-Salguero, J., Esteban, M.A. 1979. Actividad del agua y pH de algunos quesos españoles. Arch. Zootec. 28, 21-27.

Martínez, T. A., Medina, B. M. 1982. Contribución al estudio de los subproductos de la industria conservera de Murcia en la alimentación animal. Arch. Zootec. 31(120): 155- 169.

Martínez, A., Madrid, J., Megías, M. D., Gallego, J. A., Rouco, A.; Hernández, F. 1998. Uso de forrajes y subproductos en las explotaciones de vacuno de leche de la Región de Murcia. Arch. Zootec. 44: 33-42.

Muller, H.G. 1977. Introducción a la reología de los alimentos. Acribia, Zaragoza, España.

Purcarea, C.A. 2009. Comparative methods for fat separation in cheese products type “pressed cheese”. Anal Univi Oradea Fasc Ecotox Zoot Teh Ind Alim, 193-200.

Rohm, H., Jaros, D. 1996. Colour of hard cheese. 2. Factors of influence and relation to compositional parameters. Z. Lebensm. Unters. F. 204, 259–264.

Rosenthal, A.J. 1999. Food Texture. Measurement and perception. Aspen Publishers, Inc. Gaithersburg, Maryland.

Scholz, W. 1995. Elaboración de quesos de oveja y de cabra. Acribia, Zaragoza, España.

Stone, H. and Sidel, J.L. 2004. Quantitative Descriptive Analysis (The QDAMethod), Sensory Evaluation Practices. Elsevier Academic Press, San Diego, CA.

Theophilou, P., Wilbey, R.A. 2007. Effects of fat on the properties of halloumi cheese. Int. J. Dairy Technol. 60, 1-4.

FIGURE CAPTIONS

Figure 1. Descriptive sensory analysis of cheeses ripened for 60 days (mean values marked with * represent significant differences at $p<0.05$).

Figure 2. Consumer scores (mean values marked with different letters for each attribute indicate significant differences between samples at $p<0.05$).