v. 3, n. 3, 2023

International Journal of Biological and Natural Sciences

ANTIRADICAL CAPACITY OF DRINKS MADE WITH CHEESE WHEY AND CRANBERRY

Adys María Pérez-Martínez
Universidad de Guadalajara. Centro Universitario de los Lagos. Departamento de Ciencias de la Tierra y de la Vida. Lagos de Moreno, Jalisco, México

Virginia Villa-Cruz
Universidad de Guadalajara. Centro Universitario de los Lagos. Departamento de Ciencias de la Tierra y de la Vida. Lagos de Moreno, Jalisco, México
https://orcid.org/ 0000-0002-1442-8548

Juana Elizabeth Alba Cuevas
Universidad de Guadalajara. Centro Universitario de los Lagos. Departamento de Ciencias de la Tierra y de la Vida. Lagos de Moreno, Jalisco, México

Gilber Vela-Gutiérrez
Facultad de Ciencias de la Nutrición y Alimentos. Universidad de Ciencias y Artes de Chiapas, México

Abstract: Nutrition continues to be a food challenge since food is increasingly required, in addition to its nutritional value, to provide biologically active components in the body. Cheese whey, a by-product of the dairy industry, is a viable alternative as it has components such as lactose, fat, proteins, peptides, calcium, vitamins, among others, with highly nutritive and bioavailable biological effects. In addition, red fruits such as blueberries contain polyphenols with antioxidant activity that help against cell damage. The objective of this work was to determine the percentage of inhibition of antioxidants presented by drinks formulated with cheese whey and blueberry fruit. The proximal composition was analyzed and the antiradical capacity was determined by the ABTS method. The results show that the formulated beverages present an inhibition percentage that can compete with the trolox reference. It is concluded that drinks formulated with cheese whey and blueberry pulp can be a functional nutrition alternative in Mexico and it is also a viable use and/or application of cheese whey in the food field.
Keywords: Cheese whey, antioxidant, blueberry.

INTRODUCTION

Nutrition is an intrinsic activity of our existence that allows us to be active, have energy, and in turn, be prepared for diseases. The FAO refers to a nutritious food as those safe foods that provide essential nutrients, such as vitamins and minerals (micronutrients), fiber and other components to healthy diets that are beneficial for growth, health and development, and protect against malnutrition. The lack of good nutrition can lead to a poor quality of life and inequality between countries, for example, knowledge delay, overweight, anemia in women, etc., (FAO, 2022), this does a national and/or international problem and therefore a need to search or studyfoods that our body requires. Among the types of food, the study has focused onFunctional foods, which, in addition to their intrinsic nutritional value, have been shown to exert a beneficial effect on one or more selective functions of the organism, in such a way that they are appropriate for improving the state of health and well-being and/or for reducing the risks of certain diseases. in humanity.

Various types of products or by-products of the food industry can present benefits to humans, andl whey obtained from the separation of the milk clot during the manufacture of cheese, to the contener carbohydrates, vitamins, proteins and minerals (Illanes, 2011) is a proposed alternative for the development of functional foods(E., 2013).SpecificallyThe proteins present in the serum play a fundamental role in areas of health as diverse as intestinal motility, functioning and strengthening of the immune system, cancer, the cardiovascular system, improvement of cardiorespiratory performance and participation in increasing sports performance.

Besidesthe industrydairy has special interestin products where bioactive compounds such asantioxidants, fiber and unsaturated fatty acids in the formulation of products such asprebiotics, probiotics (Ruby Alejandra Villamil, 2020). Within these compoundsantioxidantsthey can be found in a wide variety of fruits or berries, which have a high content of bioactive phytochemicalshighly valued for having a therapeutic potential withimportance in the organism (Ruben Muñoz Salgado, 2013). fruits like theblueberry (V. corymbosum L.) that have good consumer acceptancein the world,toIn addition to its nutritional contribution, it has a high content of phenolic compounds, with a predominance

of phenolic acids andflavonoids, the latter include anthocyanins, which are pigments that intensify the color of blueberries, and which also have some biological activities such as anti-inflammatory,anti obesogenicand antioxidants (Daniel Tánori-Encinas, 2022). The blueberry is an astringent restorative and diuretic fruit that contains a great source of fiber and vitamin C (María D. López, 2020).

Mexico is the fourth largest producer in the world and integrates the red and blue blueberry varieties mainly, this fruit is used forthe production of beverages, juices or nectars, dWhere the focus of the products is regarding their active principle, such as antioxidants, as well as their flavor and their low sugar content, which can be seen in the nutritional labeling tables of each product. On the other hand, Jalisco is one of the main dairy sectors nationwide, concentrating the highest production in the Altos Norte, Alto Sur, Ciénega and Centro, in the municipalities of Lagos de Moreno, Encarnación de Díaz, San Miguel el Alto, Jalostotitlán and Tepatitlán (SIAP 2018). Milk production being then a strength of the state of Jalisco, however this activity also generates a high volume of whey production derived from the production of dairy products. It is worth mentioning that whey is a source of contamination if it is not used or treated, since it is commonly discarded into the environment as residual water. The use of whey has been proposed for the production of ethanol, organic acids, soft drinks, fermented drinks, biomass, concentrates, protein isolates and hydrolysates, edible films, support medium for encapsulating substances, xanthan production, enzymes, separation. of lactose for sweetening purposes in foods (Parra Huertas, 2009). The use of whey as the base volume for the production of beverages (considering whey as the volume of water) and the addition of a fruit that provides bioactive compounds may be another viable alternative and also contributes to the field of food and nutrition for humanity. Therefore, the objective of this work was to analyze the percentage of inhibition presented by antioxidants derived from cranberry in drinks formulated with cheese whey.

METHODOLOGY

For the present work, the cheese whey provided by the company Translíquidos SA de CV located on the highway to Puesto Km 6, Lagos de Moreno, Jalisco, was used. This company collects whey derived from various dairy industries located in the municipality of Lagos de Moreno, Jalisco. The whey was filtered to eliminate any solids present, then it was centrifuged at 5000 rpm at 4°C for 10 minutes to reduce the fat content. It was kept at 4°C for later use.

Production of blueberry pulp

Blueberry (Vaccinium corymbosum) was purchased in packed boxes of 170 g. Visually, the fruits that presented some defect in color, shape or some microbiological damage were eliminated. The chosen fruits were washed and disinfected, then placed in an extractor (Taurus, Vitale model). The extracted pulp was concentrated 2 times its volume over low heat for 5 minutes.

Preparation of cheese whey and cranberry pulp drinks

For the preparation of the drinks, the blueberry pulp was used at 2% and 10%, for both cases the cheese whey was added at 50% (Mena, 2002).

Determination of proximal composition

In the cheese whey, as well as in the formulated drinks, the protein content (NMX-F-068-S-1980), total solids

(NMX-F-527-1992), ash (NMX-F-066-S-1978) and grease (NMX-F-387-1982); acidity (NMX-F-511-1988), pH (NMX-F-317-S-1978), °Brix (NMX-F-103-1982).

Determination of antiradical capacity

The analysis of antiradical activity was carried out by the ABTS method,named for the reagent 2,2'-azinobis (3-ethylbenzothiazoline-6-sulfonic acid). The technique measures the ability of the antioxidants present in the sample to reduce the radical cation ABTS•+, in comparison with the standard curve of Trolox at different concentrations.(García AJ, 2002) (Diana-Chavely Restrepo-Sánchez, 2009). For the analysis, a 7 mM ABTS solution was prepared with 2.45 mM potassium persulfate and left to stand in the dark for 16 hours to obtain the ABTS radical.$^{+}$. Subsequently, the radical was diluted with PBS (pH 7.4) until reaching an absorbance of 0.7000 +/- 0.02 (Jenway 6305740 spectrophotometer, 740 nm). To analyze the antioxidant capacity, a methanolic extract was prepared with the beverage samples. The sample was mixed twice with 80% and 100% methanol. In the first mixture, the supernatant was separated and the precipitate was mixed with 100% methanol, in this second mixture the supernatant was recovered.

The supernatant recovered from both mixtures (methanolic extract) was protected from light and kept at -20°C until use. This extract was used to make the curve following the same procedure as the standard curve (E. Mata Kuskoski, 2005). With the standard curve and the curve of the samples, comparisons of the antioxidant activity between them are made as reported (Ganem IJ,centrifugalto 10,000 rpm for 15 minutes, the supernatant was separated and transferred to another microtube, 500 µl of 100% methanol was added to the pellet, vortexed and centrifuged at 10,000 rpm for 15 minutes, the supernatant was recovered and it was transferred to the microtube containing the supernatant obtained from the first centrifugation and the volume was adjusted to 2 ml. The microtubes with the methanolic extract were protected from light and kept at -20°C until use. This extract was used to make the curve following the same procedure as the standard curve (E. Mata Kuskoski, 2005). The results were expressed in % inhibition.

RESULTS AND DISCUSSIONS

Beverages made with cheese whey and blueberry pulp.

Table 1 shows the results of the proximal analysis of whey, juice and nectar. In them it can be seen that a similarity in the values of the components of the cheese whey and of the elaborated drinks except for the protein content which had a decrease in both drinks being lower in drink 2, both values are below what was obtained by (Panesar, 2007), (Abaigar, 2009) and (Callejas, 2012). Regarding the °Brix, which measures the amount of sugar present in a food (25 °Brix is equivalent to 25 grams of sugar), this value increased notably in drinks B1 and B2 with respect to cheese whey, this was to be expected. taking into account that sugar is added in the preparation of the blueberry pulp concentrate.

Analysis (%)	cheese whey	drink 1	drink 2
total solids	5.0 ± 0.001	16.0 ± 0.86	19 ± 0.43
Protein	1.08 ± 0.009	0.40 ± 0.005	0.70 ± 0.027
Fat	0.1 ± 0.001	0.10± 0.001	0.10± 0.001
Ash	0.64 ± 0.001	0.44± 0.001	0.51± 0.001
pH	4.3 ± 0.0001	4.0±0.001	4.0 ± 0.00003
Acidity	0.22 ± 0.001	0.20± 0.0003	0.30± 0.000003
°Brix	5.5 ± 0.02	14.0 ± 0.001	17.0 ± 0.083

Note: Whey from cheese production. Drink 1, prepared with 50% whey and 2% cranberry pulp. Drink 2, prepared with 50% whey and 10% blueberry pulp.

Table 1. Results of the proximal analysis of cheese whey, juice and nectar.

The specifications to identify if a drink is considered nectar are shown in table 2. It shows the values in °Brix of nectars of some fruits, for example nectar with mango have 13.5 °Brix, with apple 11.5 °Brix, with guava 8.5 °Brix and with cranberry 10 °Brix. Taking these values into account and comparing them with the formulated drinks (B1, 14 °Brix and B2 17 °Brix) we can label the formulated drinks as nectars. It is worth mentioning that these values are in reference to the °Brix value of the separated juice, so in order to reach a greater conclusion, the minimum content of juice or pulp must be analyzed, which must be between 25 and 30.

	°Brix value of separated juice	Minimum juice content and/or pulp (% v/v) in nectars of fruit)
Mango	13.5	25
Apple	11.5	fifty
Guava	8.5	25
Red cranberry	10	25
B1	14	np
B2	17	np

Data taken from CODEX STAN 24-2005 and NOM-173-SE-2021 (FRUITS).

Np (data not determined).

Table 2. Specifications for natural or reconstituted nectars.

Antiradical capacity of drinks with cheese whey and cranberry pulp.

Figure 1 shows the inhibition percentage obtained with the trolox standard in comparison with blueberry pulp and formulated drinks (B1, B2). The inhibition percentage of the pulp concentrate is higher compared to the trolox standard, this indicated that the pulp concentrate has greater anti-radical capacity than the trolox standard, as reported (Shiow W., 2008), (Ganem IJ, 2011) and (Pérez NV, 2013) However, this behavior decreased in prepared beverages, being lower in B1 with respect to B2, this is consistent considering that B2 has a higher content of blueberry pulp, which increases its antiradical capacity..

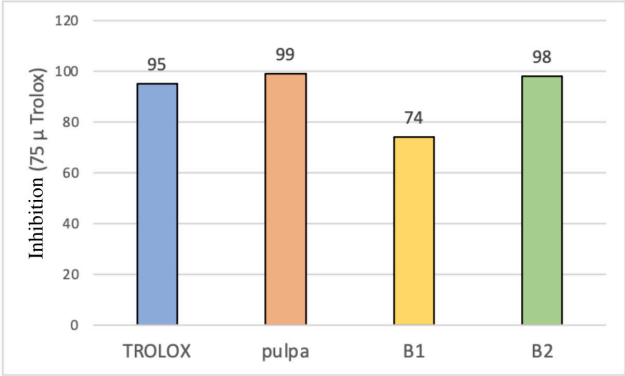

Figure 1. Comparison of the inhibition percentage of the trolox standard with blueberry pulp and formulated drinks (B1, B2).

CONCLUSIONS

The reason for the development of drinks with whey cheese and adding the blueberry fruit, considered highly antioxidant, is due to the need to develop foods that have the function of providing health benefits beyond the nutritional part. Therefore, the challenge of generating nutritional and functional foods is a determining factor in the field of the food industry.

In this work it was demonstrated that the drinks formulated with cheese whey generated in Lagos de Moreno and the integration of blueberry generates a nectar-type drink that can provide the body with antioxidants that inhibit more than 90% of free radicals according to what was obtained with the trolox standard.

In addition, cheese whey is a product generated in the dairy industry and has had little use at the national level, so research related to the use or use of cheese whey is required.

REFERENCES

Abaigar, A. (2009). El lactosuero en la alimentación del ganado porcino. *ITG Ganadero*, 13-17.

Callejas, H. (2012). Caracterización fisicoquímica de lactosuero: potencialidad de recuperación de fosforo. *Acta universitaria, Universidad de Guanajuato.*, 11-18.

Daniel Tánori-Encinas, A. W.-M.-L.-O.-S. (2022). Cápsulas de polvo de arándano como propuesta nutracéutica para mejorar la bioaccesibilidad de compuestos fenólicos. *REVISTA DE LA SOCIEDAD LATINOAMERICANA DE NUTRICIÓN*, *27* (1), 11-22.

Diana-Chavely Restrepo-Sánchez, C.-E. N.-C.-P.-S. (2009). EXTRACCIÓN DE COMPUESTOS CON ACTIVIDAD ANTIOXIDANTE DE FRUTOS DE GUAYABA CULTIVADA. *quim.Nova*, *32* (6), 1517-1522.

E. Mata Kuskoski, A. G.-F. (2005). APLICACIÓN DE DIVERSOS MÉTODOS QUÍMICOS PARA DETERMINAR ACTIVIDAD ANTIOXIDANTE EN PULPA DE FRUTOS. *Ciencia, Tecnología, Alimentos. Campina*, 726-732.

E., E. P. (2013). whey, generalities and potential use as source of calcium from high bioavailability. *rev. chil.*, *40* (4), 397-403.

FAO, F. O. (2022). El estado de la seguridad alimentaria y la nutricion en el mundo 2022. Adaptación de las políticas alimentarias y agrícolas para hacer las dietas saludables más asequibles. *Roma FAO*, ANEXO 7. pp 224.

CODEX STAN 247-2005. NORMA GENERAL DEL CODEX PARA ZUMOS (JUGOS) Y NÉCTARES DE FRUTAS (CODEX STAN 247-2005)

Ganem I. J., P. E. (2011). In vitro evaluationof Mucuna pruriens (L) DC. Antioxidant activity. *Brazilian Journal of Pharmaceutical Scences*, 536-544.

García A. J., P. M. (2002). Evaluación de las propiedades antioxidantes en concentrados de uva y frutas rojas. *An. Vet.*, 103-114.

Illanes, A. (2011). Whey upgrading by enzyme biocatalysis. *Electronic Journal of Biotechnology*, 1-28.

María D. López, M. I. (2020). CHANGES OF PHENOLIC COMPOUND CONTENTS UNDER DIFFERENT PRODUCTION SYSTEMS OF BLUEBERRIES. *Bioagro*, *32* (3), 169-178.

Mena, P. W. (2002). Formulación y elaboración de dos bebidas refrescantes con base en suero dulce de queso fresco y sabores de frutas.

Panesar, P. J. (2007). Bioutilisation of whey for lactic acid production. *Food Chemistry*, 1-14.

Parra Huertas, R. A. (2009). LACTOSUERO:IMPORTANCIA EN LA INDUSTRIA DE ALIMENTOS. *Rev. Facultad Nacional de Agronomia Medellín*, *62* (1), 4967-4982.

Pérez N. V., L. C. (2013). Extracción de compuestos fenólicos de la cáscarade lima (Citrus limetta Risso) y determinación de su actividad antioxidante. *Revista de Ciencias biológicas y de la salud*, 18-22.

Ruben Muñoz Salgado, A. P. (2013). Efecto inhibitorio del jugo de arándano (Vaccinium Macrocarpon) sobre microorganismos en saliva de niños estudios "in vitro". *Oral, Benemérita Universidad Autónoma de Puebla* (46), 1030-1034.
Ruby Alejandra Villamil, G. E. (2020). Desarrollo de productos lácteos funcionales y sus implicaciones en la salud: Una revisión de literatura. *rev Chil Nutr*, *6* (47), 1018-1028.

Sánchez F. J., R. M. (2015). Compuestos fenólicos, actividad antioxidante y bioaccesibilidad intestinal in vitro de un jugo de zarzamora termoultrasonicado. *Educación y dalud boletín científico de ciencias de la salud del ICSA*.

Shiow W., C. C. (2008). Fruit quality, antioxidant capacity, and flavonoid content of organically and conventionally grown blueberries. *J. agric Food*, 5788-5794.