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Development and Evaluation of Different Formulations of a Functional Drink "Golden Milk" and Acceptance from Local Adult Population

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Abstract

Golden Milk consist of coconut or almond drink with turmeric (*Curcuma longa).* It is used in ayurvedic medicine for potential health benefits granted by the turmeric. Noncommunicable Diseases (NCD) lead the podium for health problems, cancer being second in line. Turmeric's curcuminoids grant antioxidant, antiinflamatory, and antimicrobial effects. This research consisted on evaluating two different relations of oil:maltodextrin to encapsulate and emulsify Turmeric´s curcumin (3 g) using two different milk analogs. Physical-chemical analysis (color, viscosity, curcumin concentratrion and fatty acid profile) was done on the treatments. A Completely Randomized Design (CRD) was used with a 2 x 2 factorial arrangement evaluating the relation between oil:maltodextrin (1.5:1.5 and 2:1) and the type of milk analog (almond or coconut) plus two commercial controls using the same milk analogs. A Complete Randomized Block design (CRBD) was used to evaluate the sensory analysis. The data were analyzed using an analysis of variance with a significance level of 95% probability. The commercial control with coconut milk and treatment with 1.5:1.5 (oil:maltodextrin) with coconut milk resulted with the most luminosity, while treatment with 2:1 (oil:maltodextrin) with the same milk analog resulted with the highest values for a* (6.85 ± 0.06) and b* (56.36 ± 0.54) indicating yellow/red prominent tones. All drinks showed non-Newtonian behavior with pseudoplastic performance. Treatments with 1.5:1.5 (oil:maltodextrin) had the highest concentration of curcumin in the drink and were also well evaluated for taste in the sensory analysis (28 non-trained panelist). It is recommended to evaluate the radical scavenging properties of the drinks to evidence health claims.

Key words: ayurvedic, curcumin, emulsion, pseudoplastic, turmeric-based drink.

Resumen

La “Leche Dorada” consiste en una bebida de coco o almendras con cúrcuma (*Curcuma longa).* Es usado en la medicina ayurvédica por los potenciales beneficios a la salud que otorga la cúrcuma. Las enfermedades no transmiscibles (ENT) lideran el podio por problemas de salud, siendo el cáncer el segundo lugar. Los curcuminoides de la cúrcuma le otorgan propiedades antioxidantes, antiinflamatorias y antimicrobiales. Esta investigación consistió en evaluar dos relaciones diferentes de aceite:maltodextrina para encapsular y emulsificar la curcumina (3 g) utilizando dos análogos de leche diferentes. Se realizaron análisis fisico-químicos (color, viscosidad, concentración de curcumina y un perfil de ácidos grasos) a los tratamientos. Se utilizó un diseño completamente al azar con un arreglo factorial 2x2 evaluando la relación entre aceite:maltodextrina (1.5:1.5 y 2:1) y el tipo de análogo de leche (Almendra o coco) más dos controles comerciales usando los mismos analogos de leche. El análisis sensorial se evaluó mediante bloques completos al azar. Los datos se analizaron mediante un análisis de varianza con un nivel de significancia del 95% de probabilidad. El testigo comercial con leche de coco y el tratamiento 1.5:1.5 (aceite:maltodextrina) con leche de coco obtuvieron los resultados de mayor luminosidad, mientras que el tratamiento con 2:1 (aceite: maltodextrina) con leche de coco resultó con los valores de a* (6.85 ± 0.06) y b* (56.36 ± 0.54) más altos indicando tonos predominantes de amarillo/rojo. Todas las bebidas mostraron comportamiento no Newtonianos con un desempeño pseudoplástico. Los tratamientos 1.5:1.5 (aceite: maltodextrina) resultaron con la mayor cantidad de curcuminoides en la bebida, además de ser los mejores evaluados para el sabor en el análisis sensorial (28 panelistas no entrenados). Se recomienda hacer un análisis de propiedades antioxidantes en las bebidas para evidenciar declaraciones de propiedades saludables.

Palabras clave: ayurveda, bebidas a base de cúrcuma, curcumina, emulsión, pseudoplástico.

Introduction

Currently, Noncommunicable Diseases (NCD) lead the podium for health/rank problems in the adult population (Abad and Vasena 2020), most of them inflammatory ailments. According to the World Health Organization (WHO), cancer represents the second disease of the Noncommunicable Diseases (NCD) with most deaths worldwide (9 million people each year); 85% of these deaths are "premature", individuals between 30 and 69 years old (WHO 2021). Currently, the cancer rate in Honduras reported for 2020 were 10,628; prostate cancer and breast cancer being at the top of the list (GCO 2020). Due to the high incidence rate, different strategies have been developed to alleviate NCDs. Medicinal plants have been a staple of traditional herbal medicine practices and have been an important part of historical medicine. The World Health Organization (WHO 2021) considers natural and traditional medicine, where treatments with medicinal plants are included, to be the most effective, innoxious, besides having a rational cost and being accepted by people. This comes from the knowledge that some plants have therapeutic properties that are beneficial to humans.

The food besides having a nutritive function, they offer functionality that has a potential positive effect beyond basic nutrition (Valenzuela A et al. 2014). Therefore, "Golden Milk" is commonly used in ayurvedic medicine (traditional medicine in India for more than four millenniums) for its potential benefits to human health (Kharat and McClements 2019). The "Golden Milk" drink is a milk analog (usually almond or coconut) with turmeric extract or powdered added.

Formulations for the "Golden Milk" drink varies, yet the main ingredient is turmeric (*Curcuma longa L.*), a perennial herb. This plant belongs to the *Zingiberaceae*, originated in southeast-Asia. The phenolic compound present in its rhizome, distinctively bright yellow, the curcuminoids (desmethoxycurcumin, bis-desmethoxycurcumin and cyclocurcumin) grant to this plant the key proven medicinal properties (Cano-Higuita et al. 2015). Curcuminoids are the bioactive compounds that yields

the antioxidant, anti-inflammatory, antineoplastic, anti-proliferative and antimicrobial effects (Gopinath H 2017). Up until 2020, there is estimated to be more than 2300 scientific studies over turmeric, proving its medicinal properties and the impact that it has on human health (Narayana and Durg 2021). Even so, the physicochemical and antioxidative properties of Curcuma-based drinks has not been reported (Abd Rashid et al. 2022). Nonetheless, the main problems of turmeric are its poor stability and low aqueous solubility (Cano-Higuita et al. 2015). There are various methods of encapsulation of insoluble material; one of the strategies to improve turmeric's solubility is the formulation of microemulsions of oil in water (O/W). Microemulsions are two liquids that usually do not mix, these are stabilized with a layer of surfactant. Other methods used to improve stability are microencapsulation with spray drying, extrusion, coacervation, lyophilization and to counteract the difficulty comprised of hydrophilic groups are used as wall materials, such as maltodextrin and gelatins (Ashraf et al. 2021).

According to the IFT (Institute of Food Technologist), functional foods were the number one trend in 2021, due to the consumers awareness that some foods can help prevent NCDs, adults with more incidence of these cases. Thereby, it is intended to provide the local population with a functional drink such as "Golden Milk", looking to complement the population health by incorporating bioactive compounds through this product.

Based on these considerations, the aim of this work was to determine the effect of different combinations of emulsions oil:water (O/W) over curcuminoids solubility in the drink "Golden Milk". Evaluate the physico-chemical properties of the "Golden Milk" using coconut and almond milk analog. Evaluate the level of acceptance of the four developed treatments over the two controls of the adult population from the Yeguare Valley.

Materials and Methods

During the months of July to October of 2021, a literary research of turmeric and the "Golden Milk" drink was made. Also, the acquisition of materials (Control treatment "Golden Milk" instant powder drink from Sunfood superfoods at Costco, powdered turmeric from Sunfood superfoods at Costco, powder guar gum from Bob's Red Mill at "La Colonia" supermarket, sunflower seed oil from Cada Día at the local market and the almond and coconut milk analogs from Silk at Pricesmart) with which the preliminary testing was done. It was evaluated on different solvents to improve turmeric's solubility, which was determined using the spectrophotometer UV-Vis.

Research Location

The study was done at Zamorano University where all the variables were evaluated due to the focus on the local adult population. The evaluation of sensory acceptance on an aimed adult population was managed on a geographic range of Yeguare Valley and the adult panelists were chosen from 27 to 60 years old to evaluate the limits of the study. The obtained results will be of service to future reformulations and research to the drink industry.

The different treatments (Table 1)were prepared and evaluated at Innovation Food Plant, the Food Analysis Laboratory of Zamorano, and the Food Microbiology Laboratory of Zamorano.

Table 1

Treatment description using different oil:maltodextrin relations and milk analogs.

Treatment	Relation oil: maltodextrin	Type of milk analog
TRT1 (CNTRL Alm)	0	Almond milk
TRT2 (1.5:1.5 Alm)	1.5:1.5	Almond milk
TRT3 (2:1 Alm)	2:1	Almond milk
TRT4 (CNTRL Coco)	0	Coconut milk
TRT5 (1.5:1.5 Coco)	1.5:1.5	Coconut milk
TRT6 (2:1 Coco)	2:1	Coconut milk

Note. Treatment 1 (Commercial Control and Almond milk), Treatment 2 (1.5:1.5 oil:maltodextrin and Almond milk), Treatment 3 (2:1 oil:maltodextrin Almond milk), Treatment 4 (Commercial control and Coconut milk), Treatment 5 (1.5:1.5 oil:maltodextrin and Coconut milk), Treatment 6 (2:1 oil:maltodextrin and Coconut milk).

The relation of oil:maltodextrin in the experiment was on an increasing scale to evaluate the performance of the emulsion. Technically the relation 1.5: 1.5 is a 1:1 relation. Treatments with 0 relation of emulsion belongs to the control treatments. Following, the drink milk analogs were evaluated on each of the relations previously established. All treatment descriptions are reflected in Table 2.

Table 2

Formulation description for each treatment.

Treatment (TRT)	Quantity (g)	Percentage (%)
TRT1		
Almond milk	250	98.82
Golden Milk	3	1.18
TRT2		
Almond milk	250	97.33
Turmeric	3	1.18
Sunflower seed oil	1.5	0.58
Maltodextrin	1.5	0.58
Guar Gum	0.1	0.04
Spice mix	0.75	0.29
TRT3		
Almond milk	250	97.32
Turmeric	3	1.18
Sunflower seed oil	2	0.78
Maltodextrin	1	0.39
Guar Gum	0.1	0.04
Spice mix	0.75	0.29
TRT4		
Coconut milk	250	98.82
Golden Milk	3	1.18
TRT5		
Coconut milk	250	97.33
Turmeric	3	1.18
Sunflower seed oil	1.5	0.58
Maltodextrin	1.5	0.58
Guar Gum	0.1	0.04
Spice mix	0.75	0.29
TRT6		
Coconut milk	250	97.32
Turmeric	3	1.18
Sunflower seed oil	2	0.78
Maltodextrin	1	0.39
Guar Gum	0.1	0.04
Spice mix	0.75	0.29

Food Elaboration

Each of the six treatments described was made at the Innovation Food Plant of the Food Science and Technology department. To start, with the help of a small bowl, the turmeric (3 g) and sunflower seed (1.5 or 2 g) oil was mixed until obtaining a thick paste, while on a separate bowl the other dry ingredients

(1.5 or 2 g of maltodextrin, 0.37 g of ginger, 0.36 g of cinnamon, and 0.007 g of allspice) were mixed and then proceeded to incorporate the paste and dry ingredients into one separate bowl until obtaining a powdered mix. After this, the milk analog was added and mixed until fully dissolved. The amount per serving was determined by the RTCA 67.01.60:10 (Reglamento Técnico Centroamericano, for its acronym in spanish), 250 mL for the category of beverages 2. Coffee, tea, sweetened, and flavored (RTCA 2014). Each experimental unit was placed in a Ziploc® and stored at 4 °C. The treatments were analyzed the same day of preparation.

UV-Vis Absorbance Evaluation and Curcumin Concentration

Absorbance was measured at 425 nm using an UV-Vis spectrophotometer from Agilent Technologies (Model Cary 8454). The absorbance of the six treatments were evaluated in three replicates. The extraction of the curcuminoids was done by placing 0.2 g of the powdered treatments and dissolved in 20 mL of acetone and mixed in magnetic stirrer for five minutes. Thereafter, the treatments were placed in the centrifuge for 10 minutes to then be measured in the spectrophotometer UV-Vis at 425 nm, with 2 mL of sample in the absorbance cuvette, placed in the measuring camera and secured to be evaluated. The concentration of the curcuminoids was determined using the results of absorbance and the extinct molar absorptivity value for curcumin in acetone. The molar extinct coefficient for curcumin in acetone was determined to be 78,297 M^{-1} cm^{-1} at 419 nm (Ahali Abadeh et al. 2020). The following Equation 1 was isolated for molar concentration:

$$A = \varepsilon c l \rightarrow \ c = \frac{A * DF}{\varepsilon l} \quad [1]$$

Where:

$A = Absorbance$

$DF = Dilution\ Factor$

$c = concentration$

$\varepsilon = Extinct\ absorptivity\ coefficient$

$l = Pathlength\ (1\ cm)$

Viscosity Evaluation

This parameter was measured with the help of the rheometer of Brookfield DV-III Ultra v6 using spindle 1.0 with revolutions per minute (rpm) from 5 to 25 (increasing every 5 rpm) and measured by three replicates. For this purpose, 500 mL of the sample were placed in a beaker with a thermometer to measure the temperature. To start measuring, the torque had to be over 10% to ensure an accurate result. The results were taken every two min after the measurement was stable.

Color Evaluation

The evaluation was made with the help of the HunterLab colorimeter following the method AN 1018.00 to determine the color of the six treatments. This measurement was performed by three replicates. The colorimeter was calibrated to then measure the control treatment to then measure the rest of the treatments. The measuring cup was cleaned with distilled water and dried with tissues (Kimwipes) after every use. The L* value evaluates luminosity, a* represents the degree of redness (+) or green (-), and value b* evaluates the degree of yellowness (+) or blueness (-).

Characterization of a Fatty Acid Profile

This evaluation was made by gas chromatography with the AOCS Ce 2b-11 and AOCS Ce lj-07 methods for the six treatments. Using a 250 mL beaker to hold the treatment and with the help of a magnetic stirrer, the solution was mixed for 15 minutes and treated for 15 minutes in the ultrasound to assure proper dissolution and homogenic treatments. To start, a crude fat extraction by AOAC 2003.06 method was done using the Soxtec™ 8000 extraction unit. To extract the fatty acids, the metal cups were

placed in the forced-air oven at 105 °C to remove the excess humidity for seven h. The treatments with the analog were mixed (50 mL) and dried in the forced-air oven for seven h in an Erlenmeyer. Subsequently, the treatments were scrapped off to obtain a powdered mix again. The treatments was then placed into cellulose thimbles that had 2 g of Celite and defatted cotton, once the treatments was over these, another layer of cotton was added. The metal cups were weighted. The thimbles were placed to be suspended in the chamber, following with the metal cups that then the entire system was closed down to then inject 80 mL of hexane to each of the thimbles and 5 mL extra on the first one. Once the extraction program was done, the metal cups were removed and placed in the forced-air oven for 30 min to evaporate any hexane that may have been left behind in the metal cups. Subsequently, the metal cups were removed from the oven and placed in a desiccator for 30 min to cool down and then be weighted. Thereafter, a transesterification was done by using three test tubes for each replicate. In the metal cups with the crude fat previously extracted, 2 mL of isooctane were added to dilute the fat and then transfer the solution from the metal cups to the first of test tube (of each replicate) and then 0.5 mL of methanolic potassium hydroxide (KOH) 2M, it was capped the test tube and mixed in the vortex for eight min. Each repetition rested for 10 min and then the superior phase (isooctane) was moved into the next test tube. After this, 1 g of sodium sulfate was added to the solution and then it was mixed on the vortex for eight min and rested for 10 more minutes. Using a micropipette, 1 mL of the isooctane phase was transferred from the test tube into the previously labeled vials that belong to the gas chromatograph. The vials were placed in the gas chromatograph ready for injection to begin. The program was run automatically, when the results came back, the peaks were identified using the standard solution GLC-463 from Nu-chekprep (MN, USA).

Sensory Analysis

The sensory attributes of the treatments were evaluated on different areas of Zamorano University including, the dairy lab, the meat lab, and the animal science department hallways; due to the limited time that the panelist had, mobilization was done on behalf of the experiment. For the evaluation, the panelist were local (from the Yeguare Valley) people, adult ages (27 to 60). For this affective evaluation 30 non-trained panelists were used. Each panelist received a napkin, a cracker, the six treatments in 141 gr cups, a pen, and the evaluation sheet (Appendix A). The temperature at serving was at 17 °C and the evaluations were done at 10:30 am. For this analysis, Complete Randomized Blocks (CRB) were used.

Microbiological Analysis

According to the RTCA 67.04.50:17, group 14: Non-alcoholic beverages. Subgroup 14.1 Non-carbonated bottled beverages, pasteurized. The mix of powders for instant drinks are not liable to any microbiological testing (Reglamento Técnico Centroamericano 2018). Even though, a mold and yeast analysis were performed on the treatments to assure it was safe for consumption therefore, three dilutions (10^{-3}) were made. The day prior to the inoculation, all the utensils needed were sterilized in the autoclave (pipettes, petri plates, and test tubes), and the Rose Bengal Chloramphenicol Agar (ARBC) was prepared. The next day, 10 g of each treatment was weighted and placed into a sterilized bag, 90 mL of phosphate buffer was added and proceeded to homogenize in the masticator for 60 s. The first dilution (10^{-1}) was extracted from the bag with the help of a pipette and placed on the first petri plate with 15 mL of ARBC following. For the second dilution (10^{-2}), 1 mL of solution from the bag was added to the test tube with 9 mL of phosphate buffer (discarding the pipette used) and mixed in the vortex for seven s. Then, 1 mL was extracted from the test tube into the petri plate with 15 mL of ARBC following. For the third solution (10^{-3}), 1 mL was extracted (with a new sterilized pipette) from the second solution and placed in another test tube (10^{-3}) with 9 mL of phosphate buffer. The third (10^{-3}) test tube was mixed in the vortex

for 7 s to then transfer 1 mL to the petri plate following 15 mL poured into the plate. The same process was made for all six treatments. After inoculation, the treatments remained in an incubator for five days at 25 °C. At day five, the count was done to each treatment set.

Experimental Design

The experimental design consisted of a Completely Randomized Design (CRD) with two-by-two factorial arrangement plus two commercial controls. The variables analyzed were the relation between oil:maltodextrin (1.5:1.5, and 2:1) and the type of milk analog (almond or coconut). The treatments were evaluated by three replicates for a total of eighteen experimental units (Table 1). Although, for the sensory analysis, complete randomized blocks were used due to the lack of panelist and number of treatments (6). The data obtained were analyzed by means of an analysis of variance using Duncan test for the comparison between the means at a significance level of $P \leq 0.05$.

Results & Discussion

Curcumin Concentration in Powder Treatments

Treatments with the 1.5:1.5 (oil:maltodextrin) relation had a greater performance, differentiating significantly from the rest of the treatments (Table 3). The highest value could be attributed to the performance of emulsion of the maltodextrin and the guar gum (polysaccharides). It can be observed in Table 3 that the more oil is added to the emulsion it has an inverse performance over the curcuminoid concentration. These contrast with the reported by Park et al. (2018) whom showcased high encapsulation efficiency using Glycerol Monostearate (GMC) due to the accommodation with curcuminoids molecules. However, Park et al., evaluated a water in oil emulsion, these could have a higher influence than an emulsion oil in water. Based on the obtained results in can be inferred that, the 1.5:1.5 relation had the best performance that can be explained with the molecular structure; curcuminoids have a mirroring structure (Tomren et al. 2007), having two ketones and two aldehyde groups that associate with the oleic fatty acid and the OH- group that associates with the maltodextrin through hydrogen bonding. On a relation 2:1 there is more oil, reducing the amount of associated curcuminoids with the total oil in the formulation.

Table 3

Duncan mean separation for curcumin concentration.

Relation Oil: Maltodextrin	Concentration (mg/100 g) ± SD
Control	61.61 ± 2.39^{b}
1.5:1.5	72.53 ± 0.80^{a}
02:01	64.15 ± 1.87^{b}
P	0.0067
CV (%)	2.44

Note: Control: "Golden Milk" instant powder drink from Sunfood superfoods. CV: Coefficient of Variation. P: Probability. SD: Standard Deviation. $^{a-b}$: Different letters shows significant difference between treatments ($P \leq 0.05$).

Color

The treatments prepared in powder form were mixed with the analogs of coconut and almond milk. After that, the physical and chemical characteristics of each of the prepared beverages were

evaluated. According to the results from the Hunter L*a*b colorimeter shown in Table 4, Treatments 4 (Control with Coconut milk) and 5 (1.5:1.5, oil:maltodextrin with Coconut milk) showed the highest rate of luminosity, in the range of 71.4 - 71.7. Therefore, non-significant luminosity (L*) difference was found between both. These two showed an increase that could be related to the coconut milk analog. According to a study done by (Rincon et al. 2020), the coconut extract has the highest value of luminosity and could be compared to UHT cow's milk or this value respectively. In contrast, Treatment 2 (1.5:1.5, oil:maltodextrin with Almond milk) had the lowest rate in the parameter L* with values around 63.7, indicating the lack of luminosity in the drink.

The parameter a* on the colorimeter values were all positive indicating the redness degree of the treatments. These values ranged from 1 to 6.8 and showed significant differences between treatments. Treatment 6 (2:1, oil:maltodextrin with Coconut milk) was differentiated for resulting in the highest value of redness of the experiment. Whilst Treatments 3 (2:1, oil:maltodextrin with Almond milk) and 5 (1.5:1.5, oil:maltodextrin with Coconut milk) presented the lowest values of a*, yet staying on the redness degree.

The b* value results were all positive, demonstrating the proclivity to the yellowness degree, coherent with the Cano-Higuita et al. (2015) definition of the turmeric dye. Treatment 6 (2:1, oil:maltodextrin with Coconut milk) was evidently prominent in the yellowness degree differentiating predominantly from the other treatments. The yellowness of the treatments could also be related with the added oil since, most of them have high b* values. According to a study done by (Lamas et al. 2014), sunflower seed oil lays on the yellow/red color scale.

Similar beverages with were evaluated by Hussein AM. S. et al. (2020) who developed fortified drinks with almond drink and banana juice obtaining similar results to the present study. Similar values between luminosity with Treatment 1 (control with almond milk) at 67 (L*) and suchlike values for a*, specifically for Treatment 2 (1.5:1.5 oil:maltodextrin and almond milk) with values 4 (a*). However, the results for b* values were higher on the present study that could be attributed to the curcumin

distinctive yellow color. Comparatively, other studies with curcumin and milk were done by (Gao et al. 2022), whom also found similar results for luminosity (L*) in comparison with whole milk and curcumin. Similarly, a* values also varied between 1-7 on whole milk with curcumin, low-fat milk with curcumin and skim milk with curcumin. However, results for b* values were slightly higher in Treatment 6 for the present study. These could be attributed to the load of curcumin, being higher than the one reported in the study by (Gao et al. 2022).

Table 4

Mean separation for color on the L, a and b scale.

Treatment	L* ± SD	a* ± SD	b* ± SD
TRT1 (CNTRL ALM)	67.16 ± 0.41 [b]	3.36 ± 0.22 [c]	38.66 ± 0.65 [e]
TRT2 (1.5:1.5 ALM)	63.71 ± 0.54 [c]	4.92 ± 0.28 [b]	46.88 ± 0.29 [c]
TRT3 (2:1 ALM)	66.97 ± 0.27 [b]	1.26 ± 0.10 [d]	48.46 ± 0.96 [c]
TRT4 (CNTRL COCO)	71.69 ± 0.17 [a]	5.10 ± 0.08 [b]	43.78 ± 0.56 [d]
TRT5 (1.5:1.5 COCO)	71.43 ± 0.16 [a]	1.02 ± 0.06 [d]	52.96 ± 0.02 [b]
TRT6 (2:1 COCO)	66.63 ± 1.63 [b]	6.85 ± 0.06 [a]	56.36 ± 0.54 [a]
P	<.0001	<.0001	<.0001
CV (%)	1.07	4.33	0.91

Note: CV: Coefficient of Variation, P: Probability. SD: Standard Deviation. [a-e]: Different letters in each column shows significant difference between treatments (P ≤ 0.05). Treatment 1 (Commercial Control and Almond milk), Treatment 2 (1.5:1.5 oil:maltodextrin and Almond milk), Treatment 3 (2:1 oil:maltodextrin Almond milk), Treatment 4 (Commercial control and Coconut milk), Treatment 5 (1.5:1.5 oil:maltodextrin and Coconut milk), Treatment 6 (2:1 oil:maltodextrin and Coconut milk).

Viscosity

The data shown in Table 5 reflects that the treatments resulted as non-Newtonian fluids with a pseudoplastic behavior, which is characterized when an increasing shear rate decreases the apparent viscosity of the fluid (Chhabra 2010). Treatments 1, 5 and 6 showcased the most similar behavior to an almost linear conduct. On the other hand, Treatment 4 performed a drastic decay demonstrating a difference over the other treatments. The broadest change in viscosity occurred from 5 to 10 rpm over all the treatments, this could be because the treatments required some initial stress to be applied to start flowing easily. Other studies show how almond milk performs as a Non-Newtonian fluid with pseudoplastic behavior (Manzoor MFaisal et al. 2019).

Coconut and almond milk can be considered colloidal systems, due to the droplets of oil dispersed in water phase (Simuang et al. 2004). Subsequently, both of these result with a decrease of apparent viscosity at the increase of shear force. Simuang et al., also explained the relation of higher fat content, and the apparent viscosity decreased. In addition, their results showcased a significant effect of temperature on the viscosity of coconut milk.

Table 5

Viscosity performance in rheometer.

Treatments	5 rpm mPa.s ± SD	10 rpm mPa.s ± SD	15 rpm mPa.s ± SD	20 rpm mPa.s ± SD	25 rpm mPa.s ± SD
TRT1 (CNTRL ALM)	38.10 ± 0.95^{f}	34.17 ± 1.02^{d}	32.83 ± 1.36^{c}	31.70 ± 1.85^{c}	34.17 ± 0.85^{b}
TRT2 (1.5:1.5 ALM)	83.53 ± 0.12^{c}	60.40 ± 1.40^{b}	47.77 ± 2.38^{b}	42.13 ± 2.04^{b}	9.43 ± 0.49^{f}
TRT3 (2:1 ALM)	113.97 ± 2.89^{a}	73.73 ± 3.99^{a}	59.63 ± 3.19^{a}	58.13 ± 1.15^{a}	49.83 ± 0.35^{a}
TRT4 (CNTRL COCO)	91.20 ± 0.44^{b}	10.97 ± 0.60^{e}	11.07 ± 0.72^{d}	13.00 ± 0.87^{d}	13.50 ± 0.66^{e}
TRT5 (1.5:1.5 ALM)	54.50 ± 3.05^{d}	39.70 ± 0.46^{c}	33.60 ± 0.50^{c}	29.47 ± 0.20^{c}	27.77 ± 0.91^{d}
TRT6 (2:1 COCO)	49.43 ± 1.65^{e}	36.23 ± 1.85^{dc}	33.53 ± 0.71^{c}	31.40 ± 0.53^{c}	30.03 ± 0.38^{c}
R-square	0.997	0.994	0.991	0.994	0.998
P	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
CV (%)	2.64	4.6	4.89	3.77	2.35

Note: CV: Coefficient of Variation, P: Probability. SD: Standard Deviation. $^{a-f}$: Different letters in each column shows significant difference between treatments (P ≤ 0.05). Treatment 1 (Commercial Control and Almond milk), Treatment 2 (1.5:1.5 oil:maltodextrin and Almond milk), Treatment 3 (2:1 oil:maltodextrin Almond milk), Treatment 4 (Commercial control and Coconut milk), Treatment 5 (1.5:1.5 oil:maltodextrin and Coconut milk), Treatment 6 (2:1 oil:maltodextrin and Coconut milk).

Characterization of Fatty Acids

On Table 6, the most pertinent fatty acids from the drink are shown. Treatments 1 (CNTRL with almond milk) and Treatment 2 (1.5:1.5 oil:maltodextrin with almond milk) reflects the least amount of saturated fats. These also showcased the most monounsaturated fats matching up with (Maghsoudlou et al. 2016), fatty acid composition for almond milk. Surprisingly, Treatment 3 (2:1 oil:maltodextrin almond milk) contains almond milk and the only fatty acid found, saturated, was C18:0 (Stearic acid). The treatments with fatty acids C8:0 (Caprylic acid), C10:0 (Capric acid), C12:0 (Lauric acid), C14:0 (Myristic acid), C18:1 (Oleic acid), and C18:2 (Linoleic acid) can be attributed to the coconut milk (Raghavendra and Raghavarao 2010). Also, C14:0 (Myristic acid) can be found in sunflower seed oil (Onemli 2012). It can also be observed that the monounsaturated fats were predominant in the drinks with almond milk, however Treatment 3 (2:1 oil:maltodextrin coconut milk) present no monounsaturated or polyunsaturated fats; the monounsaturated fats can be found in sunflower seed oil and in turmeric (Maghsoudlou et al. 2016; A. Attia et al. 2017). Treatment 2 (1.5:1.5 oil:maltodextrin with almond milk) presented with the most monounsaturated fats but not showing significant difference between Treatment 1 (CNTRL with almond milk) for oleic acid (18:1 11c), for SSAFA, SMUFA and SPUFA. Polyunsaturated fats are characteristic of almond milk (Torna et al. 2020), evidencing such in the present study where it can be appreciated that linoleic (18:2) is predominant in those with almond milk (Treatments 1 and 2) however, no significant difference was found between treatments for this fatty acid All treatments with coconut milk analog presented with the most saturated fats and this can be attributed to the coconut milk (Raghavendra and Raghavarao 2010).

Table 6

Duncan separation for fatty acids.

Fatty Acid	TRT1 ± SD	TRT2 ± SD	TRT3 ± SD	TRT4 ± SD	TRT5 ± SD	TRT6 ± SD	P	CV (%)
C8:0	0±0^{b}	0±0^{b}	0±0^{b}	11.21±3.99^{a}	18.28±1.02^{a}	13.55±7.66^{a}	0.0113	46.98
C10:0	0±0^{b}	0±0^{b}	0±0^{b}	16.11±13.21^{a}	14.91±0.99^{a}	8.24±2.38^{ab}	0.0788	79.50
C12:0	0±0^{b}	0±0^{b}	0±0^{b}	45.69±10.77^{a}	0±0^{b}	47.36±7.42^{a}	0.0004	31.04
C14:0	0±0^{c}	0±0^{c}	0±0^{c}	14.28±7.49^{b}	40.73±6.55^{a}	19.97±1.02^{b}	0.0008	30.34
C16:0	11.66±11.97^{ab}	6.58±0.16^{b}	0±0^{b}	6.95±1.89^{b}	26.86±6.69^{a}	9.69±0.36^{b}	0.0848	58.91
C18:0	3.95±2.96^{b}	2.99±0.14^{bc}	100±0^{a}	1.79±1.83^{bc}	0±0^{c}	4.77±1.05^{b}	<.0001	7.76
C16:1 9C	0.74±0.30^{a}	0.32±0.03^{b}	0±0^{b}	0±0^{b}	0±0^{b}	0±0^{b}	0.0093	67.79
C18:1 11C	34.34±47.54^{ab}	57.88±0.52^{a}	0±0^{b}	0±0^{b}	0±0^{b}	0±0^{b}	0.1287	126
C18:2 9C 12C	49.33±32.89^{a}	32.25±0.25^{ab}	0±0^{b}	0±0^{b}	0±0^{b}	0±0^{b}	0.0587	98.62
SSAFA	15.60±14.94^{b}	9.56±0.30^{b}	100±0^{a}	100±0^{a}	100±0^{a}	100±0^{a}	<.0001	8.57
SMUFA	35.07±47.83^{ab}	58.20±0.55^{a}	0±0^{b}	0±0^{b}	0±0^{b}	0±0^{b}	0.1275	125.33
SPUFA	49.33±32.89^{a}	32.25±0.25^{ab}	0±0^{b}	0±0^{b}	0±0^{b}	0±0^{b}	0.0587	98.62

Note: CV: Coefficient of Variation, P: Probability. SD: Standard Deviation. $^{a-e}$: Different letters in each column shows significant difference between treatments (P ≤ 0.05). Treatment 1 (Commercial Control and Almond milk), Treatment 2 (1.5:1.5 oil:maltodextrin and Almond milk), Treatment 3 (2:1 oil:maltodextrin Almond milk), Treatment 4 (Commercial control and Coconut milk), Treatment 5 (1.5:1.5 oil:maltodextrin and Coconut milk), Treatment 6 (2:1 oil:maltodextrin and Coconut milk).

Microbiological Analysis

Microbiological analyses were done to ensure safety at consumption. However, because the product will be in powder form, the theoretical water activity (a_w) will be below 0.45. According to the RTCA, group 14: Non-alcoholic beverages. Subgroup 14.1 Non-carbonated bottled beverages, pasteurized; the mix of powders for instant drinks are not liable to any microbiological testing (Reglamento técnico centroamericano 2018). Therefore, the results for mold and yeast evaluation are reflected in Table 7. It can be observed that all treatments had a count below 10^3 CFU/g; according to (MINSA 2003) this indicates that the product was stable and could be consumed without problem. Other studies with similar powders containing maltodextrin state, that these have a greater improvement on the stability conditions for Noni powders (Fabra et al. 2011).

Table 7

Yeast and mold results.

Treatment	Concentration (CFU/g)
TRT1	<10
TRT2	<10
TRT3	<10
TRT4	<10
TRT5	$<10^2$
TRT6	<10

Note: Results reflected in CFU/g estimated value. CFU: Colony Forming Unit. Treatment 1 (Commercial Control and Almond milk), Treatment 2 (1.5:1.5 oil:maltodextrin and Almond milk), Treatment 3 (2:1 oil:maltodextrin Almond milk), Treatment 4 (Commercial control and Coconut milk), Treatment 5 (1.5:1.5 oil:maltodextrin and Coconut milk), Treatment 6 (2:1 oil:maltodextrin and Coconut milk).

Sensory Analysis

According to the results in Table 8, the attributes smell, and color presented with non-significant difference. Meanwhile, taste showcased two major significant difference between treatments; Treatments 2 and 5 were the best evaluated by the panelists. This can be awarded to the emulsion; both of these treatments had the same relation 1.5:1.5 of oil:maltodextrin. According to the general acceptance results, only Treatment 3 showed significant difference between each other. Nevertheless, no major significant difference was found between the other treatments evaluated. On the hedonic scale, the attributes were least ranked as “moderately disliked” (3), this can be credited to the lack of knowledge of the product being a functional drink. Previous studies done with curcuma-based drinks evaluated the sensory acceptability of different types of curcuma (Temulawak and Turmeric), indicating that turmeric (*Curcuma longa)* showcased the highest mean scores for overall acceptability (Abd Rashid et al. 2022). However, the geographical position is an important factor that can influence the acceptance from the spice. The previous study was done in the middle east, while the present study was done in Central America, the cultural and social aspects could have impacted the general acceptance. This is inferred due to other studies whom have evaluated acceptance from the coconut and almond drinks, and have showcased high acceptability on all attributes evaluated (color, flavor, taste, and overall acceptance) (Yetunde and Ukpong 2015; Wang W et al. 2020).

Table 8

Duncan mean separation for sensory analysis attributes.

Treatments	Smell (ns) ± SD	Color (ns) ± SD	Taste ± SD	Acceptance ± SD
TRT1	4.73 ± 2.09	5.08 ± 2.24	3.27 ± 2.13[b]	4.08 ± 1.83[ab]
TRT2	5.50 ± 2.02	5.15 ± 2.34	4.58 ± 2.00[a]	4.73 ± 1.82[a]
TRT3	4.88 ± 1.82	4.88 ± 2.39	3.35 ± 2.28[b]	3.96 ± 1.59[b]
TRT4	5.19 ± 1.77	4.81 ± 1.94	3.27 ± 2.07[b]	4.15 ± 1.67[ab]
TRT5	5.38 ± 1.36	5.31 ± 2.15	4.42 ± 1.98[a]	4.69 ± 1.54[ab]
TRT6	5.00 ± 2.26	5.46 ± 2.25	3.38 ± 1.98[b]	4.31 ± 1.81[ab]
P	<.0001	<.0001	<.0001	<.0001
CV (%)	27.11	28.57	45.66	27.86

Note: CV: coefficient of Variation, Pr: Probability, SD: Standard Deviation, ns: non-significant difference, [a-b] different letters in each column show significant difference between treatments (P ≤ 0.005).

As determined, the attributes of smell and color had a median correlation with the general acceptance. Meanwhile, the taste attribute has an elevated correlation with the general acceptance, meaning the attribute with most influence. According to (Grasso 2018), individuals with "no health information" about the functional drink scored significantly less than those with "health information." However, a functional drink can be valued by its health benefits and not much by its sensory attributes since the purpose of the produce is to complement one's health. Depending on the target consumers and the income of these, will impact the acquisition of functional produce with the sole purpose of solving health problems.

Table 9

Correlation between sensory attributes.

Pearson coefficient correlation			
Attributes	Smell	Color	Taste
General Acceptance	0.59457	0.47342	0.71591

Nutritional Facts

The following nutritional tables were made theoretically using the software Genesis R&D® (Esha Research). It was also measured already dissolved in the drink determined for treatments with the best performance in this study (Treatments 2 and 5).

The nutritional label above (Figure 1), shows a low source of energy, no saturated fats, and no cholesterol according to the (RTCA 2014), Annex E. These macronutrients were low and cero following annex E from the RTCA for nutritional labeling. However, there is a considerable amount of total fats that can be interpreted as monosaturated and polyunsaturated fats from the ingredients of such (Table 6). The nutrient reference values considered from the stablished reference values by FAO/WHO.

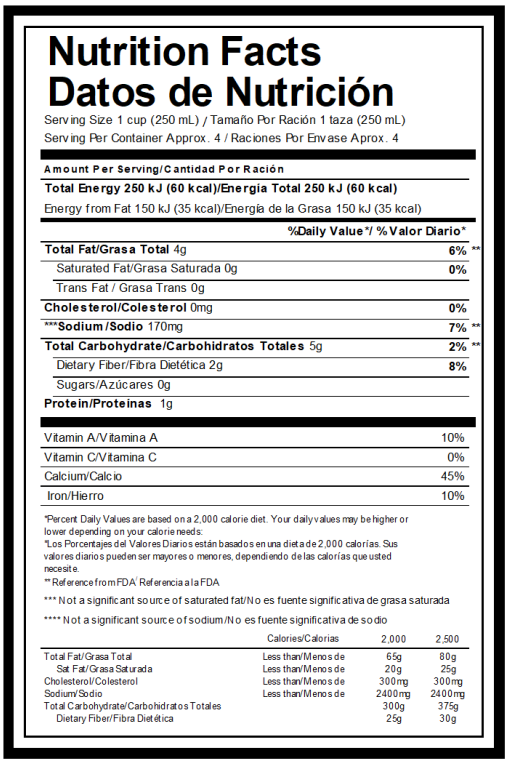
Calcium on the nutritional label 1.5:1.5 (oil: maltodextrin) and almond milk, can be considered high or good source for having twice or more (358 mg/per serving or 45% DV) than that for source (10% DV per serving). This mineral is attributed to the drink analogs trying to simulate milk adding calcium carbonate (Appendix E and F).The Food and Agriculture Organization (FAO), establishes that calcium helps reduce the pathogenesis of osteoporosis in elders and can strengthen bones for adequate development in children and pregnant women (FAO 2020).

According to the Figure 1 and annex E from the RTCA for nutritional labeling, the drink can be considered a source of iron and vitamin A for having 10% of reference nutritional value (RNV) (1.8 mg/per serving). The World Health Organization (WHO) states that, iron is lost with cells from the human body each day, an essential mineral (FAO 2020). Therefore, a Dairy Value (DV) of 14 mg of iron is recommended on a 2,000 kcal diet (RTCA 2014). While, vitamin A dairy value (DV) is established to be 900 mcg (FDA 2020). Vitamin A is involved in immune function, cellular communication, growth and development, and male and female reproduction (National Institute of Health 2022). The drink provides with source and good source of these vitamins and minerals that add to the nutritional value of it. The drink analogs also are fortified with vitamin A to simulate milks nutrients (Annex E and F). Interestingly, the Iron is attributed to the turmeric powder (Annex D). Previous studies done by (Withanage et al. 2015), show how turmeric main mineral is potassium, following Iron content exceeding the maximum limit recommended by the World Health Organization (14 mg).

However, curcumin is not declared in the label because there is no acceptable dairy intake (ADI) for such as a bioactive compound (curcuminoids), only as a food additive (3 mg/kg body) (Joint Committee FAO/WHO 2020). In order to declare health properties from the curcuminoids, functional physiological properties information should be provided to the health ministry, and an acceptable diary intake (ADI) should be settled.

Figure 1

Nutritional label based on RTCA regulations for 1.5:1.5 (oil:maltodextrin) and Almond milk analog.



Nutrition Facts
Datos de Nutrición

Serving Size 1 cup (250 mL) / Tamaño Por Ración 1 taza (250 mL)
Serving Per Container Approx. 4 / Raciones Por Envase Aprox. 4

Amount Per Serving/Cantidad Por Ración	
Total Energy 250 kJ (60 kcal)/Energia Total 250 kJ (60 kcal)	
Energy from Fat 150 kJ (35 kcal)/Energia de la Grasa 150 kJ (35 kcal)	
	%Daily Value*/ %Valor Diario*
Total Fat/Grasa Total 4g	**6%** **
Saturated Fat/Grasa Saturada 0g	**0%**
Trans Fat / Grasa Trans 0g	
Cholesterol/Colesterol 0mg	**0%**
***Sodium/Sodio** 170mg	**7%** **
Total Carbohydrate/Carbohidratos Totales 5g	**2%** **
Dietary Fiber/Fibra Dietética 2g	**8%**
Sugars/Azúcares 0g	
Protein/Proteinas 1g	
Vitamin A/Vitamina A	10%
Vitamin C/Vitamina C	0%
Calcium/Calcio	45%
Iron/Hierro	10%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:
*Los Porcentajes del Valores Diarios están basados en una dieta de 2,000 calorías. Sus valores diarios pueden ser mayores o menores, dependiendo de las calorías que usted necesite.
** Reference from FDA/ Referencia a la FDA
*** Not a significant source of saturated fat/No es fuente significativa de grasa saturada
**** Not a significant source of sodium/No es fuente significativa de sodio

	Calories/Calorías	2,000	2,500
Total Fat/Grasa Total	Less than/Menos de	65g	80g
Sat Fat/Grasa Saturada	Less than/Menos de	20g	25g
Cholesterol/Colesterol	Less than/Menos de	300mg	300mg
Sodium/Sodio	Less than/Menos de	2400mg	2400mg
Total Carbohydrate/Carbohidratos Totales		300g	375g
Dietary Fiber/Fibra Dietética		25g	30g

Note: Reglamento Técnico Centroamericano (*RTCA).*

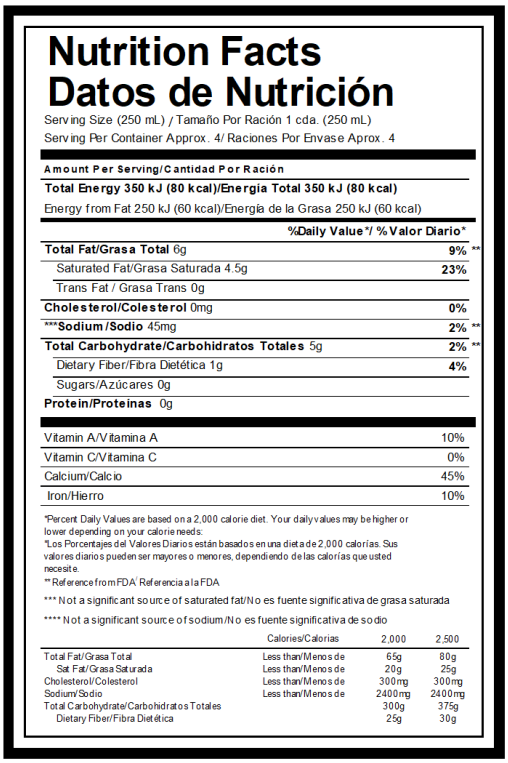
The nutritional label for Treatment 5 shows low energy, low fat, cero cholesterol, no sugar, and very low sodium following annex E (RTCA 2014). This label has higher values of total fats and saturated fats in comparison with label from Treatment 2 (Figure 1). These could be attributed to the fatty acid composition from the coconut milk analog (Table 6). However, this nutritional label contains almost four times less sodium than the label for Treatment 2 therefore it can be considered very low sodium. Both dietary fiber and protein decrease a gram in the label for Treatment 5 (Figure 2), the

dietary fiber can be attributed to the turmeric powder in both nutritional labels (Annex D). For micronutrients, it is shown that it has same exact values as Figure 1.

Considering the theoretical nutritional labeling from these treatments, Treatment 2 (1.5: 1.5 oil: maltodextrin with almond milk analog) could be considered slightly superior to Treatment 5 (1.5: 1.5 oil: maltodextrin with coconut milk analog) due to the saturated fats being inferior on Treatment 2.

Figure 2

Nutritional label based on RTCA regulations for 1.5:1.5 (oil:maltodextrin) and Coconut milk analog.



Nutrition Facts
Datos de Nutrición

Serving Size (250 mL) / Tamaño Por Ración 1 cda. (250 mL)
Serving Per Container Approx. 4/ Raciones Por Envase Aprox. 4

Amount Per Serving/Cantidad Por Ración	
Total Energy 350 kJ (80 kcal)/Energia Total 350 kJ (80 kcal)	
Energy from Fat 250 kJ (60 kcal)/Energia de la Grasa 250 kJ (60 kcal)	
	%Daily Value*/ %Valor Diario*
Total Fat/Grasa Total 6g	**9%** **
Saturated Fat/Grasa Saturada 4.5g	**23%**
Trans Fat / Grasa Trans 0g	
Cholesterol/Colesterol 0mg	**0%**
***Sodium /Sodio** 45mg	**2%** **
Total Carbohydrate/Carbohidratos Totales 5g	**2%** **
Dietary Fiber/Fibra Dietética 1g	**4%**
Sugars/Azúcares 0g	
Protein/Proteinas 0g	
Vitamin A/Vitamina A	10%
Vitamin C/Vitamina C	0%
Calcium/Calcio	45%
Iron/Hierro	10%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:
*Los Porcentajes del Valores Diarios están basados en una dieta de 2,000 calorías. Sus valores diarios pueden ser mayores o menores, dependiendo de las calorías que usted necesite.
** Reference from FDA/ Referencia a la FDA
*** Not a significant source of saturated fat/No es fuente significativa de grasa saturada
**** Not a significant source of sodium/No es fuente significativa de sodio

	Calories/Calorías	2,000	2,500
Total Fat/Grasa Total	Less than/Menos de	65g	80g
Sat Fat/Grasa Saturada	Less than/Menos de	20g	25g
Cholesterol/Colesterol	Less than/Menos de	300mg	300mg
Sodium/Sodio	Less than/Menos de	2400mg	2400mg
Total Carbohydrate/Carbohidratos Totales		300g	375g
Dietary Fiber/Fibra Dietética		25g	30g

Note: Reglamento Técnico Centroamericano (RTCA).

Conclusions

The emulsion improves the curcuminoids solubility, however, the incorporation of a polysaccharide (maltodextrin or guar gum) as wall material was necessary to boost the emulsion.

The use of milk analogs, almond and coconut drink, provide complementing nutrients that grant an extension of unsaturated fatty acids. Coconut milk provided a greater luminosity in in comparison to almond milk. The milk analogs showcased a non-Newtonian pseudoplastic property in the “Golden Milk” drink.

The taste was the attribute with the greater influence over the general acceptance of the drink. The non-trained panelist had a specific age gap (adult) that influenced the taste buds, therefore, the attribute’s values. The lack of nutritional information also influenced the taste attribute.

Recommendations

Further analysis should be made on the “Golden Milk” drink to elaborate a certified nutritional label (proximate analysis).

An antioxidant property analysis should be made on the drink to consider nutraceutical recommendation.

Coduct a comparative analysis with different types of analogs on “Golden Milk” physico-chemical and sensory acceptability.

Test different concentrations of turmeric and different mix of oils seeking a better acceptance from consumers.

Evaluate the general acceptance with two groups of non-trained panelist, a group with no information about the nutritional properties and a group with information provided.

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group%5B%5D=17&nb_items=10&group_cancer=1&include_nmsc=1&include_nmsc_other=1&projection=globe&color_palette=default&map_scale=quantile&map_nb_colors=5&continent=2&show_ranking=0&rotate=%255B10%252C0%255D.

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Appendixes

Appendix A

Evaluation bullet for sensory analysis.

Hoja de Evaluación Sensorial de "Leche Dorada"

Fecha: _____ Nacionalidad: _____ Edad: _____ Género: F M

Instrucciones: Frente a usted se presentan 6 muestras de "leche dorada" con diferentes códigos de identificación. Tomar un sorbo de agua y una pieza de galleta salada antes y después de la evaluación de cada muestra para limpiar su paladar. Luego, deguste las muestras de izquierda a derecha. Utilice la escala hedónica (Cuadro 1.) para indicar el grado en el que le gusta o disgusta cada atributo macando con un número de la escala hedónica de acuerdo con su evaluación.

Cuadro 1. Escala hedónica

1	2	3	4	5	6	7	8	9
Me disgusta extremadamente	Me disgusta mucho	Me disgusta moderadamente	Me disgusta poco	Ni me gusta ni disgusta	Me gusta poco	Me gusta moderadamente	Me gusta mucho	Me gusta extremadamente

Anote su evaluación de las muestras de acuerdo con su código:

Atributo	**Muestras por Código**
Color	
Olor	
Sabor	
Aceptación general	

Comentarios: _____

Prueba de preferencia:
Organice las muestras presentadas en orden de mayor a menor preferencia, siendo la (1) la de mayor preferencia y siendo la (6) la de menor preferencia.

Orden de preferencia	**Código de la muestra**
1)Mayor preferencia	
2)	
3)	
4)	
5)	
6)Menor preferencia	

Appendix B

Spice mix description.

Spice	Quantity (mg)
Ginger	375
Cinnamon	368
Allspice	7.5
Total	750

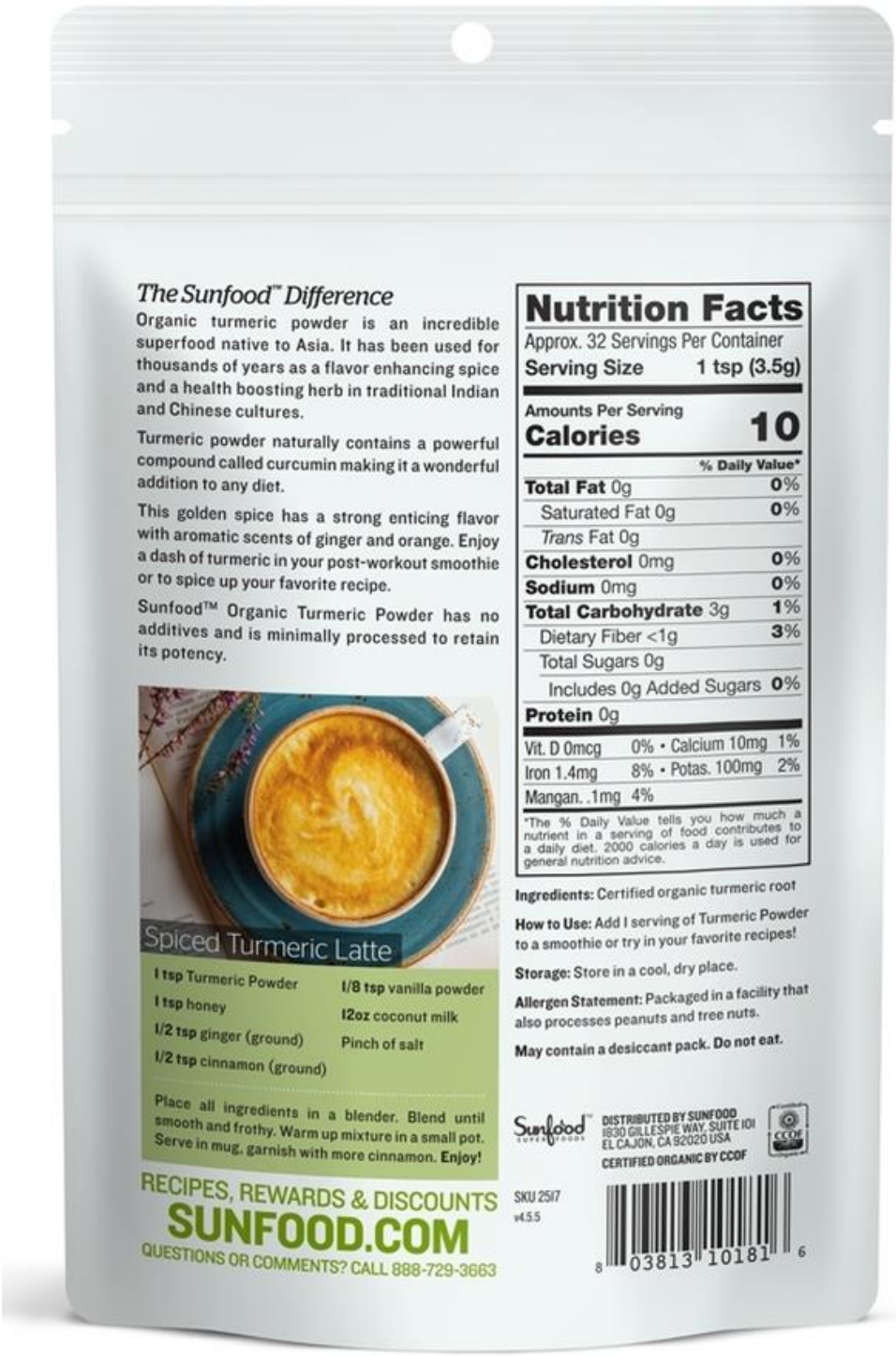
Note. The spice mix aim in the formulation is to help out the emulsion on the taste of turmeric.

Appendix C

Golden Milk Super blend from Sunfoods Nutritional label.

Appendix D

Organic Turmeric Powder from Superfoods Nutritional label.



The Sunfood™ Difference

Organic turmeric powder is an incredible superfood native to Asia. It has been used for thousands of years as a flavor enhancing spice and a health boosting herb in traditional Indian and Chinese cultures.

Turmeric powder naturally contains a powerful compound called curcumin making it a wonderful addition to any diet.

This golden spice has a strong enticing flavor with aromatic scents of ginger and orange. Enjoy a dash of turmeric in your post-workout smoothie or to spice up your favorite recipe.

Sunfood™ Organic Turmeric Powder has no additives and is minimally processed to retain its potency.

Nutrition Facts

Approx. 32 Servings Per Container

Serving Size 1 tsp (3.5g)

Amounts Per Serving

Calories 10

	% Daily Value*
Total Fat 0g	0%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 0mg	0%
Total Carbohydrate 3g	1%
Dietary Fiber <1g	3%
Total Sugars 0g	
Includes 0g Added Sugars	0%
Protein 0g	

Vit. D 0mcg	0%	• Calcium 10mg	1%
Iron 1.4mg	8%	• Potas. 100mg	2%
Mangan. .1mg	4%		

*The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2000 calories a day is used for general nutrition advice.

Ingredients: Certified organic turmeric root

How to Use: Add 1 serving of Turmeric Powder to a smoothie or try in your favorite recipes!

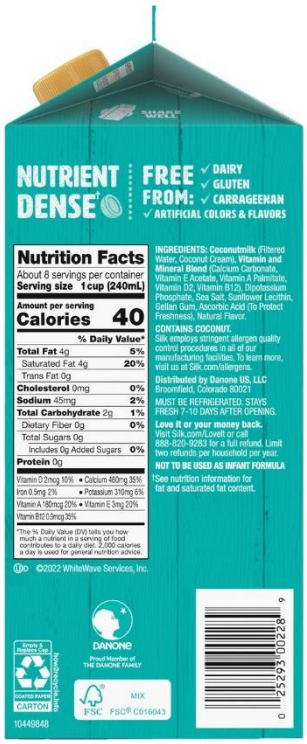
Storage: Store in a cool, dry place.

Allergen Statement: Packaged in a facility that also processes peanuts and tree nuts.

May contain a desiccant pack. Do not eat.

Appendix E

Coconut drink from Silk nutritional and front label.



Appendix F

Almond drink from Silk nutritional and front label.

Nutrition Facts

About 24 servings per container
Serving size 1 cup (240mL)

Amount per serving
Calories 30

	% Daily Value*
Total Fat 2.5g	3%
Saturated Fat 0g	0%
Trans Fat 0g	
Polyunsaturated Fat 0.5g	
Monounsaturated Fat 1.5g	
Cholesterol 0mg	0%
Sodium 135mg	6%
Total Carbohydrate 1g	0%
Dietary Fiber < 1g	2%
Total Sugars 0g	
Includes 0g Added Sugars	0%
Protein 1g	

Vitamin D 2.5mcg 10% • Calcium 450mg 30%
Iron 0.5mg 2% • Potassium 180mg 4%
Vitamin A 150mcg 15% • Vitamin E 3.8mg 25%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

INGREDIENTS: Almond base (Filtered Water, Almonds), **Vitamin and Mineral Blend** (Calcium Carbonate, Vitamin E Acetate, Vitamin A Palmitate, Vitamin D2), Sea Salt, Gellan Gum, Locust Bean Gum, Sodium Ascorbate (to protect freshness), Natural Flavor.

CONTAINS ALMOND. Produced in a facility that also processes other tree nuts and soy.

Distributed by Danone US, LLC
Broomfield, Colorado 80021

CHILL AND SHAKE WELL BEFORE SERVING. STAYS FRESH IN REFRIGERATOR 7-10 DAYS AFTER OPENING.

Visit Silk.com

NOT TO BE USED AS INFANT FORMULA

MADE IN USA

Información nutricional

Aproximadamente 24 porciones por envase
Tamaño de la porción 1 taza (240 mL)

Cantidad por porción
Calorías 126kJ

	% de valor diario*
Grasas totales 2.5g	3%
Grasas saturadas 0g	0%
Grasas trans 0g	
Grasas poliinsaturadas 0.5g	
Grasas monoinsaturadas 1.5g	
Colesterol 0mg	0%
Sodio 135mg	6%
Carbohidratos totales 1g	0%
Fibra alimentaria < 1g	2%
Azúcares totales 0g	
Incluye 0g de azúcares agregadas	0%
Proteínas 1g	

Vitamina D 2.5mcg 10% • Calcio 450mg 30%
Hierro 0.5mg 2% • Potasio 180mg 4%
Vitamina A 150mcg 15% • Vitamina E 3.8mg 25%

El % de valor diario (DV) indica la cantidad de un nutriente que le aporta una porción a su dieta diaria. La recomendación nutricional general es consumir 2000 calorías por día.

INGREDIENTES: Bebida a base de almendra (agua filtrada, almendras), **mezcla de vitaminas y minerales** (carbonato de calcio, acetato de vitamina E, palmitato de vitamina A, vitamina D2), sal marina, goma gellan, goma garrofín, ascorbato sódico (conservante), saborizante natural.

CONTIENE ALMENDRAS. Producido en instalaciones donde también se procesan otros frutos secos y soja.

Distribuido por Danone US, LLC
Broomfield, Colorado 80021

Enfriar y agitar bien antes de servir. Una vez abierto, se conserva en el refrigerador de 7 a 10 días.

Visita silk.com

NO USAR COMO FORMULA PARA BEBES

HECHO EN EE. UU.