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Qualitative Analysis of Phytochemical Compounds in Turmeric Powder as Functional Drink

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Abstract

Jamu is an Indonesian culture still preserved by the community as an alternative treatment. One of the natural ingredients often used in herbal medicine is turmeric, which has various phytochemical compounds that benefit the body. This study examines the content of tannins, alkaloids, and saponins in traditional (conventional) instant powdered turmeric drinks and factory-made (commercial) instant sour turmeric powder drinks. Analysis of the phytochemical compounds in both samples was carried out qualitatively with various reagents used. Qualitative analysis was conducted based on changes in color or appearance in both instances. Based on the research conducted shows that, conventional and commercial turmeric powder is suspected of not containing tannin compounds but saponins and alkaloid compounds. The color analysis results show that traditional turmeric powder has darker color characteristics than commercial turmeric powder. It means that turmeric powder has phytochemical compounds, so it has the potential to be a functional drink that is beneficial to health.

Keywords: *phytochemical, jamu, turmeric powder*

INTRODUCTION

The processing of medicinal plants into herbal medicine is a culture passed down from generation to generation. The culture of drinking herbal medicine is included in the traditional healing culture, which the community believes to be an effort to heal. More than 50% of Indonesian people still use herbal medicine as a treatment method (Andriati and Wahjudi 2016). Herbal medicine treatment contains active compounds from each ingredient used in processing. Active compounds that can have a health impact on the body are compounds resulting from secondary metabolites (Lantah, Montolalu, and Reo 2017).

The method for processing herbal medicine, namely boiling various spices, adding sugar, and then consuming it, has remained the same since ancient times. The measurements used in making herbal medicine include several terms for body size such as *'segengam', 'sepucuk', 'selembar', 'seruas'*, etc. The process of processing herbal medicine is done simply by boiling the selected spices in a large cauldron until it boils (Sitoresmi, et al., 2019). The principle of treatment with herbal medicine is to utilize all components of chemical compounds in medicinal plants, such as crude materials in the human body (Tsabang et al. 2015). The pattern of consuming herbal medicine as traditional medicine does not stop but continues to develop due to human thinking about adopting a back-to-nature life. The back-to-nature concept prioritizes the use of natural ingredients to meet life's needs, including in terms of medicine. The back-to-nature concept also reduces the use of synthetic drugs and prefers to use natural ingredients.

This thinking is based on an understanding that nature will fulfill human needs, including medicines.

Natural materials such as leaves, bark, flowers, and rhizomes are used as raw materials for making herbal medicine. Each material has its function because it has different chemical compounds. One of the rhizomes that is often used as herbal medicine is turmeric. Turmeric grows in branches measuring 40-100cm; the false stems form rhizomes with a yellowish color. The shape of the leaf spines is pinnate with a pale green color (Kusbiantoro 2018). Turmeric is a medicinal plant native to Southeast Asia and grows abundantly in Indonesia. The shape of the rhizome in turmeric is spreading, with the parent rhizome being oval. Turmeric has a distinctive aromatic aroma with a slightly bitter, tart taste and a deep yellow color. The dominant and easily recognizable color is turmeric, which is yellow.

The dominant compounds found in turmeric are essential oils and curcuminoids. The essential oil in turmeric contains the sesquiterpene compounds alcohol, turmerone, and zingiberene. Curcuminoid compounds, including phenolic compounds in turmeric, contain curcumin compounds and their yellow derivatives (bidesmetoxycurcumin and desmetoxycurcumin). Curcuminoid compounds help prevent infections from various types of diseases. This makes turmeric potentially anti-inflammatory and can treat different types of stomach ailments.

Turmeric in powder form is widely used to treat stomach ailments and jaundice. The dominant compound in turmeric is curcumin, which has anti-inflammatory, antioxidant, and anti-carcinogenic properties (Mahmood et al. 2015). The chemical composition of turmeric includes essential oils, fatty oils and curcuminoid compounds (Simanjuntak 2012). The curcumin compound can disrupt the life cycle of A549 lung cancer cells and suppress cell growth. The effect of suppressing cell growth depends on the concentration of curcumin. Research is currently being developed on the effectiveness of curcumin for people living with cancer. The anti-cancer activity of curcumin is associated with COX inhibition and cell signaling. This ability is also associated with antioxidant activity, carcinogenesis inhibitor, antiestrogen, and anti angiogenesis.

There are two tautomeric forms of curcumin, namely ketone and enol structures. The ketone structure is more dominant in solid form, while the enol structure is primarily found in liquid form. Various phytochemical compounds in turmeric rhizomes, including tannins, saponins, and flavonoids, benefit health. In general, there are two types of tannin in plants: condensed tannin and hydrolyzed tannin. Hydrolyzed tannins are usually found in lower concentrations in plants than condensed tannins (Lisan and Palupi 2015). Saponin is a group of glycosides in plants (Gunawan 2018).

Turmeric is widely processed into sour turmeric herbal medicine to treat stomach problems. Tamarind turmeric herbal medicine is sold in liquid form and has a low shelf life. Making herbal medicine does not involve preservatives, so turmeric herbal medicine spoils quickly in just 24 hours after cooking. The modification of processing turmeric jam into powder form is used to extend the shelf life of the herbal medicine. The powder form has a low water content, making storing turmeric herbal medicine longer possible. The powder form can also facilitate transportation and distribution because it requires less space than the liquid form. Making herbal medicine in powder form is appropriate nowadays because many people want convenience in terms of consumption. Processing turmeric into a functional drink involves extraction and crystallization processes. The extraction process is carried out using water as a solvent, and the crystallization process is carried out with the aim of separating solids from liquids by moving from the liquid phase to the crystal phase (Suharto and Hariyadi 2020). The process of making turmeric powder is carried out at high temperatures which allows damage to antioxidant compounds (Lantah, Montolalu, and Reo 2017). This research aims to test the content of tannin, alkaloid and saponin compounds in instant turmeric powder drinks made traditionally (conventional) and factory-made instant turmeric powder drinks (commercial).

METHOD

Materials

The ingredients used in making turmeric powder drinks are turmeric, water and granulated sugar. The materials used for the test are $FeCl_3$ 1% (p.a/*Merck*), reagent mayer (p.a/*Merck*), and HCl 1% (p.a/*Merck*). The tools used in the research were wooden spatulas, stoves, frying pans, blenders, 60 mesh sieves, stainless spoons, analytical scales. (Shimadzu, Jepang), and erlenmeyer (Pyrex, USA).

Method

Development of Turmeric Powder

This research includes making turmeric powder, which begins with peeling the turmeric and then washing it with running water. The turmeric that has been passed is then cut into several pieces and then blended with water (1:1); the turmeric that has been mixed is filtered using a filter cloth, separating the filtrate and dregs. The turmeric liquid that has been obtained is cooked in a large skillet over high heat while adding sugar in a ratio of 1:1, stirring periodically until the texture changes to caramel. The stove heat is reduced when the turmeric sugar liquid has become caramelized, and the stirring process is carried out again until powder is obtained. The turmeric powder collected is ground using a blender and filtered using a 60-mesh sieve. The sieve results are stored in a jar filled with silica gel and at room temperature.

Analysis of Tannin Compounds

Analysis of tannin compounds refers to research conducted by Khanifah, et al., 2020) that is, 1 ml of sample is prepared in a test tube and then reacted with 2-3 drops of 1% $FeCl_3$. A positive result indicates a change in color to green in the sample.**Analysis of Alkaloid Compounds**

Analysis of tannin compounds refers to research conducted by (Suharsanti, Astutiningsih, and Susilowati 2020) that is, 2 ml of each sample was prepared and reacted with Dragendorf's reagent and Mayer's reagent. A positive result indicates the formation of sediment in the sample.

Analysis of Saponin Compounds

Analysis of tannin compounds refers to research conducted by (Suharsanti, et al., 2020) that is, prepare 2 ml of each sample in a test tube and add distilled water. The sample was shaken vigorously vertically for 1 minute and 1 drop of 1% HCl was added and the presence of stable foam was observed. A positive sample indicates that stable foam is present.

Color Analysis

Color analysis was carried out on both samples with the Color Grab 2021 application which can be downloaded via Playstore. The two samples are placed in a room with the same light intensity, the cellphone with the application installed is directed at the two samples and the image is locked. The application will automatically analyze the L*a*b* values of the samples being analyzed.

Data Analysis

All research data obtained was analyzed descriptively by explaining the phenomena that occurred and supported by literature relevant to the research results. The literature used as a reference comes from journals from the last 10 years.

RESULTS AND DISCUSSION

Qualitative Analysis of Tannin

The results of the qualitative analysis of tannin compounds are presented in Table 1. and the results of color changes in the samples are presented in Figure 1..

Table 1. Tannin Qualitative Test Results

Sample	Changes	Explanation
Conventional turmeric powder	No colour change occurs	Does not contain tannin
Commercial turmeric powder	No colour change occurs	Does not contain tannin

Figure 1. Tannin Qualitative Test Results

The data in Table 1 shows that conventional and commercial turmeric drink samples did not show any change in color and appearance after being reacted with the FeCl3 compound. The two samples were suspected not to contain tannin compounds because there was no change in color to green (Chintya and Utami 2017). Tannins are included in the group of polyphenolic compounds with very large molecular weights (Basak et al. 2021; Fraga-Coral et al. 2020; Noer, et al., 2018). The color change in the sample is based on interactions that arise between polyphenol compounds and Fe 3^{+} ions (Sulasmi et al. 2018; Ye et al. 2018). The primary function of tannins in a biological system is to precipitate proteins and chelate metals so they can act as antioxidants. Tannin also has the potential to act as an antiseptic, so it is used in various inflammatory drugs (Astiti, et al., 2019; Raj et al. 2018; Setiawati and Crisnaningtyas 2013).

Qualitative Analysis of Alkaloid

The results of the analysis of alkaloid compounds are presented in Table 2. and the results of color changes in the samples are presented in Figure 2.

Table 2. Qualitative Alkaloid Test Results

Sample	Changes	Explanation
Conventional turmeric powder	Formed precipitate	Contain alkaloid
Commercial turmeric powder	Formed precipitate	Contain alkaloid

Figure 2. Qualitative Alkaloid Test Results

The data in Table 2 shows that conventional and commercial turmeric drink samples formed a precipitate in the test tube. A residue in the test tube indicates that the two samples are thought to contain alkaloid compounds. The precipitate formed is an orange colored precipitate obtained from nitrogen with K+ metal ions, which form a covalent bond (Sulasmi et al. 2018). Alkaloids are useful as anti-inflammatories for the body (Hu et al. 2020; Marpaung 2020).

Qualitative Analysis of Saponin

The results of the analysis of saponin compounds are presented in Table 3. and the results of color changes in the samples are presented in Figure 3.

Table 3. Saponin Qualitative Test Results

Sample	Changes	Explanation
Conventional turmeric powder	There is stable foam	Contain saponin
Commercial turmeric powder	There is stable foam	Contain saponin

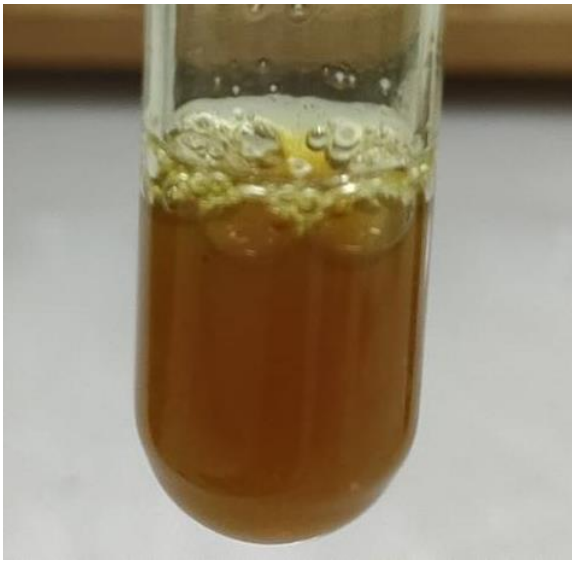

Figure 3. Saponin Qualitative Test Results

The data in Table 3 shows that conventional and commercial turmeric drink samples show stable foam. The durable foam on the sample indicates that the sample is thought to contain saponin compounds. The formation of foam means that glycoside compounds are present (Dzomba 2022; Sulasmi et al. 2018)). Saponin is useful as a hypocholesterolemic, anti-coagulant and anti-inflammatory (Addisu and Assefa 2016; Ismawati, et al., 2021).

Color Characteristics

Judging from the color characteristics of conventional turmeric powder, it has a darker color intensity than commercial turmeric powder. This color intensity is supported by the L*a*b values, namely 63.1, 21.5, and 68.8 for conventional turmeric powder and 78.3, 5.2, and 74.9 for commercial turmeric powder. The L* value refers to the brightness of the sample. Samples with a bright appearance will have a high L* value (Harnis, et al., 2019). Parameter a* shows the axis from red to green, while parameter b* shows the axis from yellow to blue.

Raw materials, food additives, and food processing influence the brightness value. Conventional turmeric powder is made by adding granulated sugar and following a heating process. During the heating process, the sugar will undergo a caramelization reaction so that the color of the powder can change to brownish (Erhardt et al. 2020; Zuliana, et al., 2015). The color of commercial turmeric powder tends to be brighter because citric acid is added to the manufacturing process. The use of acid in food processing can inhibit the browning reaction by inactivating the polyphenol oxidase enzyme (Santosa et al. 2019; Xu et al. 2022).

Turmeric contains active compounds that are beneficial for the body. Turmeric is a natural ingredient that is stable at low pH according to the pH of the digestive tract. Long-term consumption of turmeric will have a healthy digestive impact on the body (Scazzocchio, et al., 2020). Turmeric also has the potential to be a natural anti-cancer ingredient because it contains antioxidants which will neutralize free radicals in the body (Rathore et al. 2020).

CONCLUSION

Conventional turmeric powder made at home and factory-made commercial turmeric powder have similar phytochemical compounds. The extraction process in making the two samples can cause damage to several phytochemical compounds, one of which is tannin. The color analysis results show that adding chemicals in the form of citric acid can increase the brightness intensity because it can inhibit the browning reaction.

REFERENCES

Addisu, S, and A Assefa. 2016. "Role of Plant Containing Saponin on Livestock Production: A Review." *Advances in Biological Research* 10(5): 309–14.

Andriati, A, and R M T Wahjudi. 2016. "Tingkat Penerimaan Penggunaan Jamu Sebagai Alternatif Penggunaan Obat Modern Pada Masyarakat Ekonomi Rendah-Menengah Dan Atas." *Masyarakat, Kebudayaan dan Politik* 29(3): 133–45.

Astiti, N P A, S K Sudriga, and Ramona Y. 2019. "Analysis of Phenolic and Tannin Contents in the Methanol Extract of Sweet and Sour Star Fruit Plants (Averrhoa Carambola L) Leaves Commonly Used as Raw Materials of Lawar (A Balinese Traditional." *Adv Trop Biodivers Environ Sci* 3: 5–7.

Basak, S, A S M Raja, S Saxena, and P Patil. 2021. "Tannin Based Polyphenolic Bio-Macromolecules: Creating a New Era towards Sustainable Flame Retardancy of Polymers." *Polymer Degradation and Stability* 189: 109603.

Chintya, N, and B Utami. 2017. "Ekstraksi Tannin Dari Daun Sirsak (Annona Muricata L.) Sebagai Pewarna Alami Tekstil." *JC-T (Journal Cis-Trans): Jurnal Kimia dan Terapannya* 1(1).

Dzomba, P. 2022. "Formulation and Evaluation of a Herbal Shampoo Using Flavonoid Glycosides from Dicerocaryum Senecioides." *East African Journal of Science, Technology and Innovation* 3.

Erhardt, C S et al. 2020. "Sucrose as a Sol-Gel Synthesis Additive for Tuning Spinel Inversion and Improving the Magnetic Properties of CoFe2O4 Nanoparticles." *Ceramics International* 46(8): 12759–66.

Fraga-Coral, M et al. 2020. "Technological Application of Tannin-Based Extracts." *Molecules* 25(3): 614.

Gunawan, D H. 2018. "Penurunan Senyawa Saponin Pada Gel Lidah Buaya Dengan Perebusan Dan Pengukusan." *Teknologi Pangan: Media Informasi Dan Komunikasi Ilmiah Teknologi Pertanian* 9(1): 41–44.

Harnis, P, Y A Sari, and M A Rahman. 2019. "Segmentasi Citra Kue Tradisional Menggunakan Otsu Thresholding Pada Ruang Warna CIE LAB." *Pengemb. Teknol. Inf. Dan Ilmu Komput*: 2548.

Hu, Y et al. 2020. "Anti-Inflammatory Octahydroindolizine Alkaloid Enantiomers from Dendrobium Crepidatum." *Bioorganic Chemistry* 100: 103809.

Ismawati, L, I Ismawati, and R A Destryana. 2021. "Identifikasi Senyawa Saponin Pada Ekstrak Rumput Mutiara (Hedyotis Corimbosa L, (LAMK) Dengan Pelarut Yang Berbeda." In *Prosiding SNAPP, ,* 150–54.

Khanifah, F, E Puspitasari, and S Awwaludin. 2020. "UJI KUALITATIF FLAVONOID, ALKALOID, TANIN PADA KOMBINASI KUNYIT (CURCUMA LONGA) COKLAT (THEOBROMA CACAO L)." *Jurnal Ilmiah Berkala Sains dan Terapan Kimia* 15(1): 91–99.

Kusbiantoro, D. 2018. "Pemanfaatan Kandungan Metabolit Sekunder Pada Tanaman Kunyit Dalam Mendukung Peningkatan Pendapatan Masyarakat." *Kultivasi* 17(1): 544–49.

Lantah, P. L, L. A Montolalu, and A. R Reo. 2017. "Kandungan Fitokimia Dan Aktivitas Antioksidan Ekstrak Metanol Rumput Laut Kappaphycus Alvarezii." *Media Teknologi Hasil Perikanan* 5(3): 73–79.

Lisan, F. R, and S. Palupi. 2015. "Penentuan Jenis Tanin Secara Kualitatif Dan Penetapan Kadar Tanin Dari Serabut Kelapa (Cocos Nucifera L.) Secara Permanganometri." *Calyptra* 4(1): 1–16.

Mahmood, K et al. 2015. "Recent Developments in Curcumin and Curcumin Based Polymeric Materials for Biomedical Applications: A Review." *International Journal of Biological Macromolecules* 81(1): 877–90.

Marpaung, A M. 2020. "Tinjauan Manfaat Bunga Telang (Clitoria Ternatea L.) Bagi Kesehatan Manusia." *Journal of Functional Food and Nutraceutical*: 63–85.

Noer, S, R. D Pratiwi, and E. Gresinta. 2018. "Penetapan Kadar Senyawa Fitokimia (Tanin, Saponin Dan Flavonoid Sebagai Kuersetin) Pada Ekstrak Daun Inggu (Ruta Angustifolia L.)." *Jurnal Ilmu-ilmu MIPA*: 2503–2364.

Raj, A, J Vinnarasi, R Venkataraman, and M Augustin. 2018. "HPTLC Fingerprinting Analysis of Tannin Profile on Canthium Coromandelicum and Flueggea Leucopyrus Willd." *Research Journal of Pharmacy and Technology* 11(12): 5355–58.

Rathore, S et al. 2020. "Curcumin: A Review for Health Benefits." *Int. J. Res. Rev* 7(1): 273–90.

Santosa, I., A. M Puspa, D Aristianingsih, and E. Sulistiawati. 2019. "Karakteristik Fisiko-Kimia Tepung Ubi Jalar Ungu Dengan Proses Perendaman Menggunakan Asam Sitrat." *Jurnal Teknik Kimia* 6(1): 1–5.

Scazzocchio, B, L. Minghetti, and M. D'Archivio. 2020. "Interaction between Gut Microbiota and Curcumin: A New Key of Understanding for the Health Effects of Curcumin." *Nutrients* 12(9): 2499.

Setiawati, E, and F. Crisnaningtyas. 2013. "Formulasi Permen Dari Sarang Semut Asal Kalimantan Selatan." *Jurnal Riset Industri Hasil Hutan* 5(2): 31–36.

Simanjuntak, P. 2012. "Studi Kimia Dan Farmakologi Tanaman Kunyit (Curcuma Longa L) Sebagai Tumbuhan Obat Serbaguna." *Jurnal Ilmu Pertanian* 17(2): 1-3–107.

Sitoresmi, I., S Sujiman, and A. Maksum. 2019. "Keamanan Pangan Dan Teknologi Pengemasan Produk Jamu Alona Guna Peningkatkan Kinerja Produk." *Jurnal Ilmiah Pangabdhi* 5(1).

Suharsanti, R, A Astutiningsih, and N D Susilowati. 2020. "KADAR KURKUMIN EKSTRAK RIMPANG KUNYIT (Curcuma Domestica) SECARA KLT DENSITOMETRI DENGAN PERBEDAAN METODE EKSTRAKSI." *Jurnal Wiyata: Penelitian Sains dan Kesehatan* 7(2): 86–93.

Suharto, N, and A. Hariyadi. 2020. "PELATIHAN PRODUKSI JAHE INSTAN IBU-IBU DI RT. 12-RW. 03 KELURAHAN MULYOREJO KECAMATAN SUKUN KOTA MALANG." *Jurnal Pengabdian Polinema Kepada Masyarakat* 7(1): 6–6.

Sulasmi, E. S, Z. F Wuriana, M. S Sari, and S. Suhadi. 2018. "Analisis Kualitatif Kandungan Senyawa Aktif (Flavonoid, Alkaloid, Polifenol, Saponin, Terpenoid Dan Tanin) Pada Ekstrak Metanol Daun Dan Rhizoma Phymatodes Scolopendria (Burm.) Ching Di Taman Nasional Baluran." In *Seminar Nasional Hayati*, , 121–28.

Tsabang, N et al. 2015. "Treatment of Diabetes and/or Hypertension Using Medicinal Plants in Cameroon." *Medicinal & aromatic plants*.

Xu, B et al. 2022. "Flat Dual-Frequency Sweeping Ultrasound Enhances the Inactivation of Polyphenol Oxidase in Strawberry Juice." *Journal of Food Measurement and Characterization* 16(1): 762–71.

Ye, X et al. 2018. "Fabrication of 3D Porous Superhydrophobic Sponges Using Plant Polyphenol-Fe3+ Complexes as Adhesive and Their Applications in Oil/Water Separation." *Colloids and Surfaces A: Physicochemical and Engineering Aspects* 551: 9–16.

Zuliana, C, E Widyastuti, and W. H. Susanto. 2015. "PEMBUATAN GULA SEMUT KELAPA (KAJIAN PH GULA KELAPA DAN KONSENTRASI NATRIUM BIKARBONAT)[." *Jurnal Pangan dan Agroindustri* 4(1).