HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH: JURNAL ILMIAH *)

Judul Jurnal Ilmiah (Artikel)	: *Phytochemical and antioxidant capacity test on turmeric extract (Curcuma longa) traditionally processed in Bali*
Jumlah penulis	: 7 Orang
Status pengusul	: Penulis Keenam
a. Nama Jurnal	: Journal of Physics: Conference Series
b. No. ISSN	:
c. Volume, No, bulan, tahun	: Volume 1869, 2nd Annual Conference of Science and Technology (ANCOSET 2020), 28 November 2020, Malang, Indonesia
d. Halaman	: 1-5
e. Penerbit	: IOP Publishing
f. DOI artikel (jika ada)	: 10.1088/1742-6596/1869/1/012031
g. URL artikel	: https://iopscience.iop.org/article/10.1088/1742 6596/1869/1/012035/pdf
h. URL similarity	: https://bit.ly/390wrLW
i. Alamat web jurnal	: https://iopscience.iop.org/article/10.1088/1742-6596/1869/1/012035/meta
Terindek di	: Scopus Q4

Kategori Publikasi Jurnal ilmiah (*beri √ pada katagori yang tepat*)
: [√] Jurnal Ilmiah ~~Internasional~~/internasional bereputasi
[ ] Jurnal Ilmiah Nasional Terakreditasi
[ ] Jurnal Ilmiah nasional/nasional terindeks di DOAJ, CABi, Covernicus

I. Hasil Penilaian *Peer Review*

No	Komponen Yang Dinilai	Nilai Maksimal jurnal					Nilai Akhir Yang Diperoleh
		Internasional bereputasi [√]	Internasional [ ]	Nasional Terakreditasi []	Nasional ***) [ ]	Nasional Terindek DOAJ dll [ ]	
1	Kelengkapan dan kesesuaian unsur isi jurnal (10%)	3					2,4
2	Ruang lingkup dan kedalaman pembahasan (30%)	9					8,1
3	Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	9					7,2
4	Kelengkapan unsur dan kualitas penerbit (30%)	9					8,1
	Total = (100%)	30					25,8
Kontribusi pengusul (Penulis Pendamping)= (40% x)/6 =							1,72

Komentar Peer Reviewer

1. **Kelengkapan dan kesesuaian unsur isi jurnal**: Artikel sangat lengkap dan sesuai dengan kaidah penulisan artikel ilmiah internasional terindek Scopus Q4, Pada jurnal publishing terdapat judul, abstrak, pendahuluan, metode penelitian, hasil dan pembahasan, kesimpulan, dan referensi. Abstrak sangat informatif dan pustaka yang digunakan sangat memadai. Perlu dilengkapi dengan cover, redaksi, ISSN, dan daftar isi jurnal. Perlu dilengkapi dengan cover, redaksi, ISSN, dan daftar isi jurnal. Nilai 2,4

2. **Ruang lingkup dan kedalaman pembahasan** : ruang lingkup memadai dalam mengkaji tentang *Phytochemical and antioxidant capacity test*, terhadap ektrak kunyit. Paparan diskusi pembahasan secara komprehensif dengan menyajikan kajian ektrak kunyit yg diproses secara tradisional terhadap phytochemical dan antioksidan serta didukung sejumlah literatur. Nilai 8,1

3.**Kecukupan dan kemutakhiran data/Informasi serta metodologi** : Data yang dipergunakan dalam artikel ini data primer hasil penelitian serta informasi yang mutakhir dari referensi. Instrumen penelitian menggunakan objektif analisis. Metode penelitian dijelaskan secara akurat dengan metode explorative quantitative method, dari 900 respondents dari 9 kabupaten di Bali dengan cara interview sesuai dengan permasalahan. Nilai 7,2

4.**Kelengkapan unsur dan kualitas terbitan :** Kelengkapan unsur-unsur sudah memadai sebagai Artikel ini diterbitkan pada jurnal terindeks Scopus Q4, diterbitkan oleh Journal of Physics: Conference Series. 2nd Annual Conference of Science and Technology (ANCOSET 2020), jurnal ini sangat memadai dan membahas tentang bidang ilmu dan teknologi secara sangat mendalam sebagai terbitan *online* (*open access*). Nilai 8,1

5.**Indikasi Plagiasi :** tidak terindikasi plagiat dengan Similarity index 30%

6. **Kesesuaian bidang Ilmu** : Kesesuaian bidang ilmu dengan penulis keenam agak sedikit kurang yaitu teknologi pengolahan hasil perairan.

Denpasar, 28 Februari 2022

Nama : Prof. Dr. Ir. G.P. Ganda Putra, M.P.

Tanda tangan :

NIP : 196209301988031001
Japung : Guru besar
Unit kerja : Universitas Udayana

HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH: JURNAL ILMIAH *)

Judul Jurnal Ilmiah (Artikel)	: *Phytochemical And Antioxidant Capacity Test On Turmeric Extract (Curcuma longa) Traditionally Processed In Bali*
Jumlah penulis	: 7 Orang
Status pengusul	: Penulis Keenam
a. Nama Jurnal	: Journal of Physics: Conference Series
b. No. ISSN	:
c. Volume, No, bulan, tahun	: Volume 1869, 2nd Annual Conference of Science and Technology (ANCOSET 2020), 28 November 2020, Malang, Indonesia
d. Halaman	: 1-5
e. Penerbit	: IOP Publishing
f. DOI artikel (jika ada)	: 10.1088/1742-6596/1869/1/012031
g. URL artikel	: https://iopscience.iop.org/article/10.1088/1742 6596/1869/1/012035/pdf
h. URL similarity	: https://bit.ly/390wrLW
i. Alamat web jurnal	: https://iopscience.iop.org/article/10.1088/1742-6596/1869/1/012035/meta
Terindek di	: Scopus Q4
Kategori Publikasi Jurnal ilmiah (*beri √ pada katagori yang tepat*)	: [√] Jurnal Ilmiah ~~Internasional~~/internasional bereputasi [ ] Jurnal Ilmiah Nasional Terakreditasi [ ] Jurnal Ilmiah nasional/nasional terindeks di DOAJ, CABi, Covernicus

I. Hasil Penilaian *Peer Review*

No	Komponen Yang Dinilai	Nilai Maksimal jurnal					Nilai Akhir Yang Diperoleh
		Internasional bereputasi [√]	Internasional [ ]	Nasional Terakreditasi []	Nasional ***) [ ]	Nasional Terindek DOAJ dll [ ]	
1	Kelengkapan dan kesesuaian unsur isi jurnal (10%)	3					2,4
2	Ruang lingkup dan kedalaman pembahasan (30%)	9					8,1
3	Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	9					8,1
4	Kelengkapan unsur dan kualitas penerbit (30%)	9					8,1
	Total = (100%)	30					26,7
Kontribusi pengusul (Penulis Pendamping)= (40% x)/6 =							1,72

Komentar Peer Reviewer

1. **Kelengkapan dan kesesuaian unsur isi jurnal**: Artikel sangat lengkap dan sesuai dengan kaidah penulisan artikel ilmiah internasional terindek Scopus Q4, Pada jurnal publishing terdapat judul, abstrak, pendahuluan, metode penelitian, hasil dan pembahasan, kesimpulan, dan referensi. Abstrak sangat informatif dan pustaka yang digunakan sangat memadai. Perlu dilengkapi dengan cover, redaksi, ISSN, dan daftar isi jurnal. Perlu dilengkapi dengan cover, redaksi, ISSN, dan daftar isi jurnal. Nilai 2,4

2. **Ruang lingkup dan kedalaman pembahasan** : Ruang lingkup memadai dalam mengkaji tentang *Phytochemical and antioxidant capacity test*, terhadap ektrak kunyit. Paparan diskusi pembahasan secara komprehensif dengan menyajikan kajian ektrak kunyit yg diproses secara tradisional terhadap phytochemical dan antioksidan serta didukung sejumlah literatur. Nilai 8,1

3. **Kecukupan dan kemutakhiran data/Informasi serta metodologi** : Kecukupan data yang dipergunakan dalam artikel ini data primer hasil penelitian serta informasi yang mutakhir dari referensi. Instrumen penelitian menggunakan objektif analisis. Metode penelitian dijelaskan secara akurat dengan metode explorative quantitative method, dari 900 respondents dari 9 kabupaten di Bali dengan cara interview sesuai dengan permasalahan. Nilai 8,1

4. **Kelengkapan unsur dan kualitas terbitan :** Kelengkapan unsur-unsur sudah memadai sebagai Artikel ini diterbitkan pada jurnal terindeks Scopus Q4, diterbitkan oleh Journal of Physics: Conference Series. 2nd Annual Conference of Science and Technology (ANCOSET 2020), jurnal ini sangat memadai dan membahas tentang bidang ilmu dan teknologi secara sangat mendalam sebagai terbitan *online* (*open access*). Nilai 8,1

5. **Indikasi Plagiasi :** Tidak terindikasi plagiat dengan Similarity index 30%

6. **Kesesuaian bidang Ilmu** : Kesesuaian bidang ilmu dengan penulis keenam agak sedikit kurang yaitu teknologi pengolahan hasil perairan.

Denpasar, 15 Februari 2022

Nama : Prof. Dr. Ir. I Wayan Arthana, M.S.

Tanda tangan :

NIP : 196007281986091001
Japung : Guru besar
Unit kerja : Universitas Udayana

ISSN 1742-6588

Journal of Physics

Conference Series

The 11th Biennial Conference on Classical and Quantum Relativistic Dynamics of Particles and Fields

1239

VOLUME 1239 – 2019

4–7 June 2018
Mérida, Yucatán, Mexico

EDITOR
Martin Land

The open access journal for conference proceedings

iopscience.org/jpcs

IOP Publishing

OPEN ACCESS 012031

Effect of cooking time on the quality of *nila nyat-nyat* (Oreochromis niloticus)

I G S Pandit, P A N K Permtananda and K Yudha

+ Open abstract View article PDF

OPEN ACCESS 012032

Ethanol and methanol levels of red dragon fruit wine (*Hylocereus costaricensis*) with the treatment of sugar and fermentation time

I W Sudiarta, I W R Saputra, N M A S Singapurwa, I P Candra and A A M Semariyani

+ Open abstract View article PDF

OPEN ACCESS 012033

Purification of Fim-C-*Salmonella typhi* recombinant protein with Ni-NTA resin as raw material for typhoid disease detection kit

M Nurjayadi, T Setiyoto, S F Jinan, D Hardianto, A Sulfianti, K Agustini and H A El-Enshasy

+ Open abstract View article PDF

OPEN ACCESS 012034

Variation in recombinant protein production volume of Fim-C-salmonella typhi as a raw material for typhoid detection kit at laboratory scale

M Nurjayadi, S F Jinan, T Setiyoto, D Hardianto, A Sulfianti, K Agustini, D Sukmawati and H A El-Enshasy

+ Open abstract View article PDF

OPEN ACCESS 012035

Phytochemical and antioxidant capacity test on turmeric extract (*Curcuma longa*) traditionally processed in Bali

P A N K Permatananda, A A S A Aryastuti, P N Cahyawati, D P C Udiyani, D Wijaya, I G S Pandit and A A N M Wirajaya

+ Open abstract View article PDF

OPEN ACCESS 012036

Development of mobile learning integration with scientific approaches on electrolyte solution and redox reaction

U Cahyana, E Fitriani and W Utari

+ Open abstract View article PDF

OPEN ACCESS 012037

Development of mobile learning integration with scientific approach in stoichiometry

U Cahyana, T Hadinugrahaningsih and R I Luthfianisa

+ Open abstract View article PDF

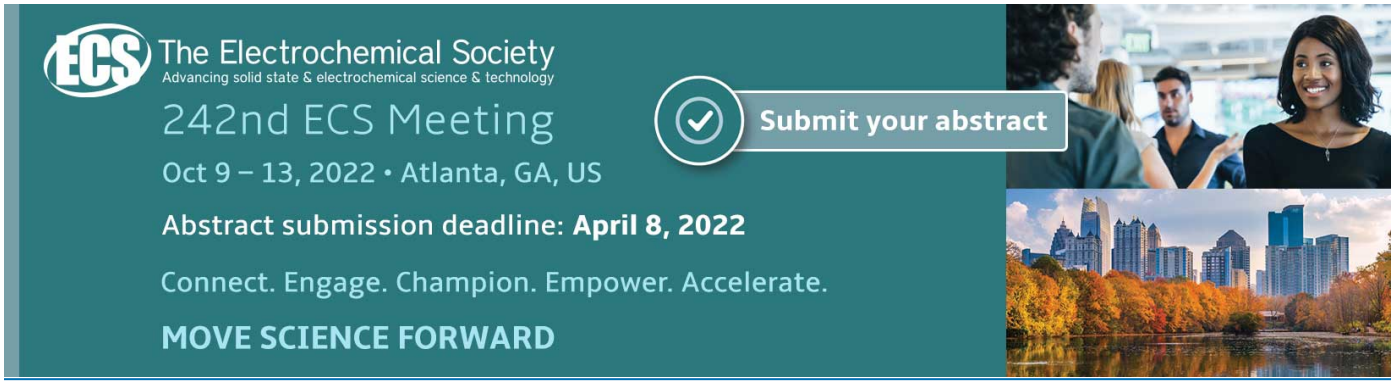
OPEN ACCESS 012038

Effect of spacing on growth and yield of several black soybean varieties (*Glycine max* L Merril)

K Maulana, M S Yuliartini, A A N M Wirajaya, I B K Mahardika and Y P Situmeang

+ Open abstract View article PDF

Phytochemical and antioxidant capacity test on turmeric extract (*Curcuma longa*) traditionally processed in Bali



Phytochemical and antioxidant capacity test on turmeric extract (*Curcuma longa*) traditionally processed in Bali

P A N K Permatananda[1,*], A A S A Aryastuti[1], P N Cahyawati[1], D P C Udiyani[1], D Wijaya[1], I G S Pandit[2,3] and A A N M Wirajaya[2]

[1] Faculty of Medicine and Health Science, Universitas Warmadewa, Indonesia
[2] Faculty of Agriculture, Universitas Warmadewa, Indonesia
[3] Postgradute Program, Universitas Warmadewa, Indonesia

*nayakasih@gmail.com

Abstract. Bali is an island that is famous for its culture, including traditional medicine. In traditional medicine, the Balinese use various kinds of medicinal plants, one of which is Turmeric. The purpose of this study was to determine the ways and objectives of the use of turmeric by Balinese, as well as the phytochemical content and antioxidant capacity of turmeric extract which is traditionally processed in Bali. The method and purpose of utilizing turmeric were obtained through observation and interviews with 900 Balinese respondents. Quantitative phytochemical tests include starch, protein, flavonoid, tannin, phenol and vitamin C levels and qualitatively for the presence of triterpenes, steroids, alkaloids, and saponins. Antioxidant capacity was measured using the DPPH method. Through this research, we found there were only 36.8% of respondents had ever used turmeric as a traditional medicine. Utilization of turmeric was mostly in the form of loloh or traditional drinks. Phytochemical test results showed turmeric extract had 67.38% starch, 3.42% protein, 2709.39 mg / 100 gr flavonoids, tannins 291.64 mg / 100gr, phenol 1584.04 mg / 100 gr, and vitamin C 0.06 mg / 100gr. Qualitatively, turmeric extract contained triterpenes, alkaloids, and saponins, but did not contain steroids. The antioxidant capacity of turmeric extract was 70.9 mg / L GAEAC. Turmeric extract is a traditional medicine made from nature that is most commonly used by Balinese and very potential to be developed as an antibacterial, antioxidant, anti-inflammatory, or other benefits that still need further investigation.

1. Introduction

Since long time ago, Indonesian people used nature for their survival. One of the natural products that have been developed is herbs that are used as traditional medicine to cure various diseases [1]. Traditional medicine derived from plants is a manifestation of the active participation of the community in solving health problems and the role has been recognized by various nations in improving the degree of public health. World Health Organization (WHO) recommends the use of traditional medicines including herbal medicines in the maintenance of public health, prevention and treatment of diseases, especially for diseases that have not yet found a cure such as chronic diseases, degenerative diseases and cancer [2].

Indonesian people mix various kinds of traditional medicinal plants into traditional herbal drink, Indonesian called them as *jamu* in Java, while in Bali they are called as *loloh*. Both *jamu* and *loloh* not only have medicinal properties but also have historical values and traditions that need to be preserved.

Based on qualitative research conducted in Java and Bali, Turmeric was included as one of the ten most traditional herbal medicine in Indonesia, including in Bali [1]. Turmeric belongs to the *zingiberacea* group which is traditionally widely used as herbs, cooking spices, food ingredients, preservatives, and food coloring in Asian countries like Indonesia. It is also used in social and religious ceremonies mentioned in *Ayurvedic* and some folk medicines, namely *Usadha* in Bali against various ailments, such as gastric, hepatic, gynecological, and infectious disease [3-5]. In particular, some scientific research stated that turmeric has various pharmacology properties, for instance as anti-inflammatory, antioxidant, antitumor, antibacterial, anticoagulant and antidiabetic due to its free radical scavenging activities [6-8]. Antioxidant properties and capacities of some turmeric have already been studied, however there are least knowledge and scientific data on the composition and activities of turmeric's antioxidant that traditionally processed in Bali. Thus, this present study was aimed to describe the use of turmeric for herbal medicine in Bali, determine antioxidant level and capacities of Balinese turmeric extract.

2. Methods

This research was carried on based on explorative quantitative method. We collected data on the use of turmeric as traditional medicine from 900 respondents spread across 9 districts in Bali by conducting interviews and observations. Turmeric usage data in this study includes the method and purpose of utilization.

2.1. Preparation of turmeric sample

The sample used was 500 grams of fresh turmeric, then finely chopped following the traditional procedure carried out in Bali. The sample is then placed in a closed jar for further procedures.

2.2. Procedure of extraction

Samples were extracted by using water as a universal solvent that can extract various active compounds contained in plants [9]. The use of water was also intended to follow procedures commonly used by the Balinese people. A total of 500 g of fresh samples were boiled using 2500 ml of water solvent at 90 ° C for 30 minutes. The extract was then filtered using filter paper and the solvent was evaporated using a rotary evaporator.

2.3. Phytochemical test

Phytochemical tests were carried out to determine the content of compounds contained in turmeric extracts. Phytochemical compound analysis includes qualitative and quantitative tests. Quantitative measurement, such as Starch test was carried out using the Luf Schrool method and titration, protein levels were determined by the Kjeldahl method, and spectrophotometers were used to measure levels of phenols, tannins, flavonoids and vitamin C. We conducted several qualitative assessments to detect triterpenoid, steroid, and alkaloid content in turmeric extract. For testing alkaloids, we added dragendorff reagents to the extract and red precipitate showed positive. Meanwhile, to detect triterpenoid and steroid contents, we dissolved the extract with chloroform, then added anhydrous acetate and H_2SO_4, brownish or violet rings indicated positive triterpenes, while positive steroids were marked in green.

2.4. Antioxidant capacity

Antioxidant activity of the extracts was determined by 1,1-diphenyl-2picrylhydrazyl (DPPH) assay which is 0.1 ml of turmeric extract was added into 0.4 mM DPPH solution and incubated for 30 min. Absorbance was measured at wavelength 516 nm. We calculated DPPH radical scavenging activity by comparing the inhibition rate with sample blank [6,10].

3. Results

From 900 respondents, we found there were 332 (36.8%) respondents use turmeric as herbal medicine. Making *jamu*/*loloh* was the most common method used by the Balinese in processing turmeric, as shown

in Figure 1. More than twenty percent of turmeric was used by Balinese to overcome gastric disorders, can be seen in Figure 2.

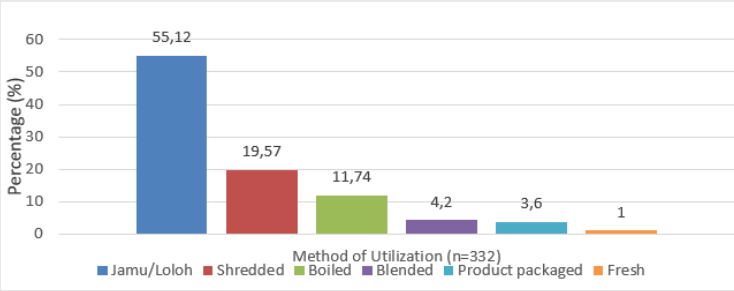


Figure 1. Turmeric's method of utilization by Balinese.

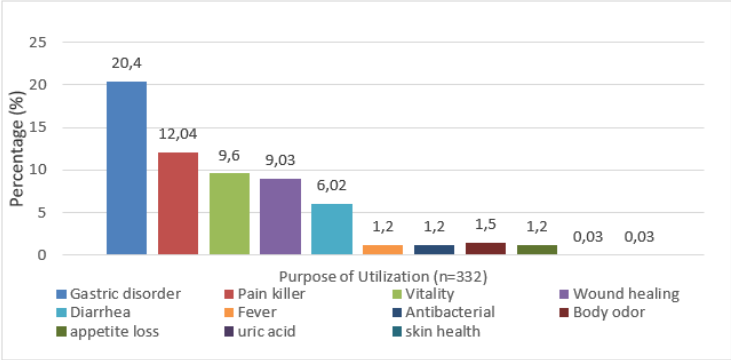


Figure 2. Turmeric's purpose of utilization by Balinese.

Phytochemical test results (Table 1) showed that turmeric traditionally processed in Bali contained starch, protein, antioxidant compounds such as flavonoids, phenols, tannins, and vitamin C which were quite large. Qualitatively, turmeric consisted of triterpenes, alkaloids, and saponins, but did not have steroids. By using the DPPH assay, turmeric antioxidant capacity was obtained at 70.9 mg / L GAEAC.

Table 1. Pythochemical and antioxidant capacity test result.

No	Type of Examination	Result
1	Starch	67.38 %
2	Protein	3.4168 %bw
3	Flavonoid	2709.39 mg/100gr
4	Tanin	291.64 mg/100gr
5	Fenol	1584.04 mg/100gr
6	Vitamin C	0.06 mg/100mg
7	Antioxidant capacity	70.9 mg/L GAEAC

4. Discussion

Indonesia is one of the countries in Asia with high use of turmeric. Turmeric has high economic and cultural values and is widely cultivated, used as a medicinal plant, planted ornamentally and is culturally important [11,12]. The biggest producer of turmeric in the world was in India. India has 150.000 hectares of land for turmeric cultivation, the majority of which is used to meet domestic needs as condiment and occupies, and only about 8% is exported periodically [12].

Turmeric belong to genus Curcuma is a member of the Zingiberaceae family and consist of aproximately 80 species. Not only spread in Southeast Asian friends, South Asia and China, several species of curcuma are also found in Asia and the Pacific [13]. Curcuma is an herbaceous plant. It has a pseudostem. The rhizome is thick and fleshy with a compound flowers appears at the end of the stem or

arises separately from the rhizome. The inside of the rhizome has a variety of colors from white, yellow, beige through orange, blue, bluish green and black [14]. Rhizome used for traditional ingredients, aroma enhancers, and natural dyes [15]. Indonesia is reported to have 15 curcuma species and Curcuma longa or turmeric is the most widely used curcuma species [11,13].

Based on a research in Central Java, they found that curcuma longa was the most widely used species as herbal medicine to treat 71 symptoms of disease, with gastritis as the most often treated conditions, followed by pre and post-partum condition, and liver disease. Only four conditions in that research that did not use Curcuma longa, namely insect repellent, slimming treatment, epilepsy, and insomnia [11]. In this study, we also found gastric disorder inlude nausea, vomiting, and epigastrial pain were the most purpose of turmeric utilization in Bali. According to *Formularium Herbal Asli Indonesia*, the use of turmeric to treat gastric problem or gastritis has evidence based medicine grade C, which is the evidence was still unclear or conflicting [16]. While previous literature mentioned that turmeric has a protective effect on gastrointestinal tract. The component of turmeric is believed to be able to inhibit intestinal spasm and increase gastrin, secretin, bicarbonate and pancreatic enzyme secretion. It can also inhibit the formation of peptic ulecer and significantly increase mucosal secretion as defense factor against gastrointestinal insults, such as alcohol, stress, caffeine, and some drugs [12,17].

Assessing antioxidant properties and extraction yield, likes in this study, is depend on both the extraction method and the type of solvent used during the extraction. The various antioxidant compound with different chemical characteristics and polarities of plant materials are soluble in different solvents [3]. We used water which is an organic polar compound that is suitable for extraction of various bioactive phytochemical. The results of the examination of starch and protein levels in this turmeric extract are not much different from the composition of starch and protein in turmeric in general [12]. Flavonoids, tannins, phenols are phytochemical compounds that have a role to maintain the taste and color, and also have important contributions in health-promoting activities as free radical scavenger. Vitamin C or ascorbic acid is a powerful antioxidant compound that not only interacts directly with ROS but also contributes to the regeneration of other antioxidants. The content of vitamin C in turmeric ranged from 0.03 to 0.11mg / 100g of turmeric and the content of vitamin C obtained in turmeric extract in this study was not much different, namely 0.06 mg / 100g. Previous research stated that ethanolic turmeric extract exhibits higher antioxidant capacity than aqueous turmeric extract. Our traditionally processed turmeric extract can be belong to aqueous extract. Antioxidant capacity that are reflected by free radical scavenging activities may be attributed to the high contents of phenolics and flavonoids with a higher reducing capacity [3]. Turmeric extract in this research has been shown natural antioxidant properties from their levels of tannin, phenols, flavonoids, vitamin C, and the appearance of triterpenes, alkaloids, and saponins. But in this study, turmeric extract did not have steroid content which can give an idea of the potentially harmless side effects of turmeric extract. The steroid content of herbal medicine could be a potent anti-inflammatory property, but the high steroid content can cause adverse drug event that harmful to the body [18,19].

5. Conclusion

Turmeric extract is a traditional medicine made from nature that is most commonly used by Balinese. Most Balinese process turmeric into *jamu/loloh* to treat various diseases, most of them are gastric diseases. This turmeric extract which is traditionally processed by Balinese people was proven to contain various phytochemical active compounds with adequate antioxidant activity as well as turmeric extract which is modernly processed with ethanol solvent. Therefore, our traditionally processed of turmeric extract is very potential to be developed as an antibacterial, antioxidant, anti-inflammatory, or other benefits, but further investigation is still needed.

Acknowledgement

This research is part of a collaborative research entitled "Mapping the Potential and Utilization of Traditional Medicinal Plants as Alternative Herbal Medicine" with the Regional Innovation Research

Agency of the Province of Bali (BADAN RISET INOVASI DAERAH PROVINSI BALI). We would like to thank all those who have helped to carry out this research.

References

[1] Sari I D, Yuniar Y, Siahaan S, Riswati and Syaripuddin M 2015 Community Tradition in Planting and Using Medicinal Plant in Surround Home Yard *Jurnal Kefarmasian Indonesia* **5** 2 123-132
[2] Agustina S 2016 The Inhibiotin of Typhonium flagelliforme lodd Blume Leaf Extract on COX-2 Expression of WiDr Colon Cancer Cells *Asian Pasific Journal of Tropical Biomedicine* **6** 3 251-255
[3] Tanvir E M, Hossen M S, Hossain M F, Afroz R, Gan S H, Khalil M I and Karim N 2017 Antioxidant Properties of Popular Turmeric (Curcuma longa) Varieties from Bangladesh *Journal of Food Quality* 1-8
[4] Gupta S C, Sung B, Kim J H, Prasad S, Li S and Aggarwal B B 2013 Multitargeting by Turmeric, The Golden Spice: From Kitchen to Clinic *Molecular Nutrition and Food Research* **57** 9 1510-1528
[5] Hasan M and Mahmud M 2014 The Contribution of Turmeric Research and Development in The Economy of Bangladesh: An Ex-Postanalysis *International Journal of Agricultural Research, Innovation and Technology* **4** 1 1-10
[6] Sera K, Seok Chun K, Yoon Sook K, Sang Keun H, Ho Young P, Yongkon P and Sang Hoon L 2019 Determination of Curcuma longa L. (Turmeric) Leaf Extraction Conditions Using Response Surface Methodology to Optimize Extraction Yield and Antioxidant Content 2019 *Journal of Food Quality* 1-8
[7] Kim D H 2016 Effects of Turmeric (Curcuma longa L) on The Physiochemical Characteristics of Kochujang Druing Fermentation *Journal of Applied Biological Chemistry* **56** 101-107
[8] Kim D W, Lee S M and Woo H S 2016 Chemical Constituents and Anti-inflammatory Activity of The Aerial Parts of Curcuma longa *Journal of Functional Foods* **26** 485-493
[9] Ahmad I, Farrukh A and Mohammad O 2006 *Modern Phytomedicine: Turning Medicinal Plants into Drugs* (Winheim, Germany: Wiley-VCH)
[10] Heo S J, Park E J, Lee K W and Jeon Y J 2005 Antioxidant Activities of Enzymatic Extracts from Brown Seaweeds *Bioresource Technology* **96** 1613-1623
[11] Subositi D and Wahyono S 2019 Study of The Genus Curcuma in Indonesia Used As Traditional Herbal Medicine *BIODIVERSITAS* **20** 5 2085-4722
[12] Sathi A S 2017 A Review on Pharmacological and Cosmeceutical Properties of Curcuma Longa *Intl J Pharmaceut Sci Res* **2**1 9-16
[13] Chen J, Xia N, Zhao J, Chen J and Henny R J 2013 Chromosome Numbers and Ploidy Levels of Chinese Curcuma Species *Hortscience* **48** 5 525-530
[14] Sirirugsa P, Larsen K and Maknoi C 2007 The genus Curcuma L (Zingiberaceae): distribution and classification with reference to species diversity in Thailand *Gard Bull Sing* **59** 2 203- 220
[15] Zhang L, Wei J, Yang Z, Chen F, Xian Q, Su P, Pan W, Zhang K, Zheng X and Du Z 2018 Distribution and diversity of twelve Curcuma species in China *Nat Prod Res* **32** 3 327-330
[16] Indonesia Health Ministry 2016 *Regulation of the Minister of Health of the Republic of Indonesia Number 6 Year 2016 Concerning Original Indonesian Herbal Formulary* (Jakarta: Indonesia Health Ministry)
[17] Akram M, Shahab-Uddin, Afzal Ahmed, Khan Usmanghani, Abdul Hannan E and Mohiuddin M 2010 Curcuma Longa and Curcumin: A Review Article *Romanian Journal of Biology– Plant Biology* **55** 2 65-70
[18] Patel S S and Savjani J K 2015 Systematic review of plant steroids as potential antiinflammatory agents: Current status and future perspectives *The Journal of Phytopharmacology* **4** 2 121-125
[19] Permatananda P A N K, Kristin E, Endharti D, Pinzon R T and Sumada I K 2018 Adverse Event of Antiepileptic Drugs: A Cross Sectional Study *MATEC Web. Conf* **197** 07004