SENSORY ATTRIBUTE PROPERTIES AND SHELF LIFE OF CHICKEN-HERBAL ESSENCE FUNCTIONAL DRINKS

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ABSTRACT

Chicken-herbal essence, a nutritionally rich functional beverage boasting elevated levels of proteins and amino acids, is renowned for its health-promoting attributes, notably its positive effects on lactation. Comprising an amalgamation of free-range chicken, red ginger, brown sugar, honey, sesame oil, nutmeg, salt, and water, this elixir undergoes a discernible deterioration in quality when subjected to prolonged storage. Consequently, imperative research endeavors are undertaken to elucidate the temporal constraints of storage for this esteemed functional drink. The present study is oriented towards gauging the degradation in quality and prognosticating the shelf life of chicken-herbal essence when exposed to three distinct temperatures—refrigerator temperature (10°C), ambient room temperature (25-27°C), and an elevated temperature (35°C)—utilizing the Arrhenius method as the analytical framework. Conducted over a rigorously observed four-week duration at both the Djuanda University Food Laboratory and the LPPOM MUI Laboratory, this study systematically examines diverse parameters, including pH levels, total dissolved solids, total plate count (TPC), and a comprehensive sensory evaluation. The pH testing, conducted employing a precision pH meter, yields a range of 4.676 – 5.074, while total dissolved solids ranged from 27,100 – 27,450 Brix; total plate count ranged from 0 – 20 CFU/mL. In the sensory test, samples at three temperatures were withdrawn upon panelists' arrival. Generally, refrigerated and room temperature storage showed higher acceptability than higher temperature (35°C) storage. Shelf life estimation indicated that refrigerated storage (10°C) extended to 53 days, surpassing the other temperatures.

Keywords: chickens, food shelf life, functional food, spices

INTRODUCTION

Originating from Asian culinary traditions, Chicken Essence is a revered elixir crafted from concentrated chicken meat extract. Its protein-rich profile endows it with cultural significance, especially for convalescents, expectant mothers, and lactating women in Asian societies (Chao et al., 2004). This elixir confers numerous nutritional benefits, including heightened protein intake, restoration of physical vigor, fatigue alleviation, and enhanced cognitive functions such as memory and concentration in educational pursuits (Li et al., 2012). A contemporary iteration, Chicken-Herbal Essence, fuses chicken extract with herbal elements. Notable ingredients like red ginger, palm or coconut sugar, nutmeg, sesame oil, and trigona honey synergistically contribute to the formulation of this nutritive elixir (Sulaeman et al., 2022).

Food product packaging mandates the inclusion of shelf life information, a critical facet linked to both product safety and the assurance of delivering quality to consumers (Kusnandar et al., 2010). However, a pertinent challenge in ascertaining shelf life is the temporal constraint. Therefore, there arises a necessity for a rapid, cost-effective method capable of approximating actual shelf life with precision (Herawati, 2008).

Estimating shelf life often involves implementing the Accelerated Shelf-Life Testing (ASLT) method, wherein food products undergo storage in an environment conducive to expedited deterioration. This method induces rapid damage by elevating temperature or humidity conditions beyond those encountered in actual storage conditions (Kusnandar 2010). A specific technique employed in research, the Arrhenius model (Suwita et al., 2017), is integral to ASLT.

The functional beverage known as chicken-herbal essence undergoes a quality decline with prolonged storage. In light of this, the research endeavors to elucidate the trajectory of this decline and estimate the shelf life of chicken-herbal essence when subjected to three distinct

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temperatures: refrigeration (10°C), ambient room conditions (25-27°C), and elevated temperature (35°C). The application of the Arrhenius method is instrumental in this investigation, offering a systematic approach to comprehend the kinetics of quality deterioration under varied thermal conditions.

METHODS

Materials and Tools

The chicken-herbal essence, a functional food product derived from chicken, utilized free-range chicken carcasses aged at 3 months from poultry farms in the Pabuaran region, Bogor Regency. Additionally, the formulation incorporated red ginger (*Zingiber rubrum var roscoe*), nutmeg (*Myristica fragrans Houtt.*), sesame oil, salt, and coconut sugar sourced from traditional markets in Warung Jambu, Bogor City, and Ciawi, Bogor Regency. Trigona honey (bee *Tetragonula biroi*) was supplied by CV Nutrima Sehatalami. Methodologically, a pressure cooker, VWR® pH1100 H-pH meter, hand-refractometer, and standard laboratory equipment were deployed for pH assessment, total plate count, total dissolved solids measurement, and sensory evaluation, respectively.

Chicken Essence Production

The formulation of Chicken-Herbal essence followed the adapted methodology from Sulaeman et al. (2022), employing a double-boiled cooking technique with a pressure cooker set at 100°C for a duration of 4 hours. The primary ingredient comprised free-range chicken, complemented by red ginger, palm sugar or coconut sugar, sesame oil, nutmeg, salt, and mineral water. Subsequent to ingredient amalgamation, excluding honey, a meticulous stirring process ensued to achieve uniformity before transferring the mixture to a small saucepan. Within this receptacle, a strategically placed inverted glass bowl facilitated the separation of chicken essence from residue during the cooking process, easing subsequent filtration. Following the cooking phase, meticulous filtration ensues to segregate residue from the essence. The incorporation of *Trigona spp* honey followed, with subsequent separation of fat and pasteurization at 80°C for 10 minutes, ensuring the formulation adheres to rigorous nutritional standards.

The Sensory Attributes Test

The sensory evaluation employed in this study adopts a hedonic approach, conducted weekly through a comparative analysis between freshly produced and stored chicken-herbal essence samples. A group of 30 semi-trained panelists participates in this evaluative process, assessing the sensory attributes, encompassing color/appearance, viscosity, smell/aroma, taste, and overall acceptability of the product (Meilgaard, Carr, & Civille, 1999). Each panelist evaluated samples at their individual tables, with specimens from three different storage temperatures withdrawn simultaneously for unbiased assessment.

Within the context of this sensory evaluation, the stored product was systematically juxtaposed against a control, the latter representing a chicken-herbal essence product crafted prior to the commencement of the sensory analysis. The assessment employed a nuanced scale, ranging from 1 (no longer acceptable) through 7 (same or better than control), offering a spectrum of descriptors that characterize the perceived changes in product quality. The scale discerned gradations of receptivity loss, from very obvious to subtle differences in comparison to the control. The scales used in this sensory test were: 1 (no longer acceptable); 2 (very obvious loss of acceptability); 3 (more obvious loss of acceptability); 4 (starting to lose acceptability); 5 (more obvious differences but still acceptable); 6 (slightly different from control) and; 7 (same or better than control).

The pH Test

The pH analysis was conducted weekly, adhering to standardized laboratory procedures as outlined in the Operating Manual VWR® pH1100. The protocol steps were: initial rinsing and cleaning of the pH electrode with distilled water and tissue, gradual immersion of the electrode into the sample, utilization of provided buffer solutions for probe stability, activation of pH or mV display via the **MODE** button, and the reading of pH

values displayed on the screen within the Stability Control Range ± 15 seconds.

The Total Dissolved Solids Test (TDS)

The assessment of total dissolved solids adhered to standardized laboratory procedures utilizing a hand refractometer. Scheduled evaluations were conducted at specific intervals, including week 0 (day 2), weeks 1, 2, 3, and 4, across all treatments and three distinct temperature conditions.

Total dissolved solids (TDS) were gauged utilizing a hand-refractometer. The procedural steps included the initial rinsing of the refractometer prism with distilled water, followed by gentle wiping with a soft cloth. Subsequently, a precise quantity of chicken-herbal essence was applied to the refractometer prism, and the Brix degree, a measure of total dissolved solids, was determined with reference to established guidelines (Wahyudi & Dewi, 2017).

The Total Microbial Test (SNI ISO 4833-1:2015)

The microbiological assessment of chicken-herbal essence was conducted weekly over a four-week period employing the Total Plate Count (TPC) method. A specific volume of the liquid test sample was introduced into an empty Petri dish and homogenously mixed with a liquid agar culture medium to generate a pouring plate. The medium of choice for this investigation was PCA (Plate Count Agar), a well-established substrate for microbial growth.

A parallel plate was prepared following identical parameters, employing decimal dilutions of the test sample or the initial suspension. Subsequently, the prepared plate underwent incubation in aerobic conditions at 30°C for a duration of 72 hours. Post-incubation, microbial counts were systematically conducted utilizing a colony counter. The quantification of microorganisms per gram or per milliliter of the test sample ensued through a rigorous calculation derived from the enumeration of colonies present on plates containing fewer than 300 colonies.

Estimating the Shelf Life of Chicken-Herbal Essence

The determination of shelf life in this experimental inquiry was conducted through the application of the Arrhenius equation. The constant representing the rate of quality degradation at three distinct storage temperatures was subsequently integrated into the Arrhenius equation, articulated as follows:

$$\ln k = \ln ko - E/RT.$$

The initial step involved establishing the correlation between the natural logarithm of the rate constant (ln k) and the reciprocal of the absolute temperature (1/T), utilizing temperature values expressed in Kelvin units.

RESULTS AND DISCUSSION

The pH Test Results

Figure 1 illustrates the average pH trajectory of Chicken-Herb essence during a 4-week storage period. A discernible correlation emerged between the pH test results and the microbial count, indicating a positive association.

Notably, the sample with the highest pH, specifically pH 5.047, exhibited the greatest microbial presence. The inclusion of trigona honey in this study, renowned for its sweet and sour taste with a pH value of 4 (Devianti, Soetarto, & Hendarto, 2015), significantly impacted the overall

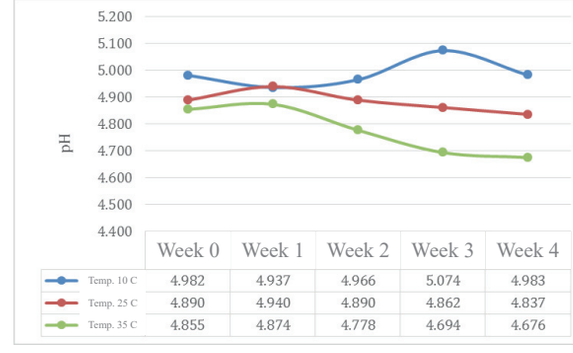

Figure 1. The average pH of Chicken-Herb essence during 4 weeks of storage at 3 different temperatures

pH of the chicken essence product, stabilizing it within the range of 4.8 – 4.9. The complex interplay of enzymatic reactions during storage is a pivotal factor influencing pH alterations, as enzymes catalyze chemical reactions leading to diverse changes in food composition (Suwita et al., 2017). Examining Figure 1, it is evident that when stored at a temperature of 10°C, there was a discernible pH increase during the 2nd and 3rd weeks, succeeded by a decline in pH by the 4th week. Conversely, Chicken Essence stored at temperatures of 25°C and 35°C exhibited a prevailing tendency towards pH reduction. This trend aligns with the findings of Rusli et al. (2022), wherein pH measurements in ginger latte drink products showcased a consistent negative trend, indicative of product compromise due to microbial fermentation activities. Microbial fermentation generates alcohol (ethanol), CO2 gas, and organic acids, contributing to heightened acidity and sourness in the product, substantiated by a concurrent decrease in pH values (Anagari et al., 2011).

The occurrence of protein denaturation can induce a shift in the product's pH towards alkalinity. Globular proteins, in particular, are prone to denaturation, resulting in alterations to their molecular composition and subsequent changes in both physical and physiological properties (Winarno, 2004). However, the observed pH shifts in the results of this investigation were relatively modest in magnitude.

The Total Plate Count (TPC) Results

As depicted in Table 1 the average count of microorganisms in Chicken-Herb Essence over a 4-week storage period is presented. Table 1 details that the microbial growth observed during storage falls within the range of 0 – 20 CFU/mL. Adhering to the regulatory guidelines outlined in BPOM Regulation No. 13 of 2019, the acceptable microbial limit is stipulated at 10^4 colonies/g, with a maximum threshold for microbial contamination in heat-treated ground and processed meat, poultry, and game meat categories set at 10^6 colonies/g. Notably, the findings underscore that the storage of Chicken-Herb essence over the 4-week duration remains well below the established limits for microbial contamination, as per regulatory standards.

An observable correlation emerges from the pH test results and the microbial counts, revealing a discernible pattern. Specifically, the sample exhibiting the highest pH, recorded at 5.047, corresponds to the highest microbial presence among the samples.

The Total Plate Count (TPC) examination adheres to the standards outlined in SNI ISO 4833-1:2015. Various groups of microorganisms exhibit distinct optimal, minimal, and maximal pH ranges conducive to their growth. Bacteria typically thrive in the pH range of 6.0 – 8.0, while yeast favors the pH range of 4.5 – 6.0, and fungi flourish in the pH range of 3.5 – 4.0. An intrinsic quality of food lies in its buffering capacity, signifying its ability to withstand pH fluctuations. Foods with low buffer capacity are susceptible to rapid pH alterations in response to acidic or alkaline byproducts generated by microorganisms. Conversely, foods with high buffer capacity demonstrate greater resilience to such pH changes (Khutami, Sumiwi, Ikram, & Muchtaridi, 2022; Asiah, Cempaka, & David, 2018). Figure 2 visually depicts the correlation between storage duration and the total count of microorganisms. A discernible pattern emerges, illustrating a relationship between the pH test outcomes and the microbial population. Specifically, the sample exhibiting the highest pH value, recorded at 5.047, corresponds to the highest microbial presence among the samples.

Table 1. Average Microorganisms Count of Chicken-Herb Essence During 4 Weeks of Storage

Temperature	Time				
	Week 0 (CFU/mL)	Week 1 (CFU/mL)	Week 2 (CFU/mL)	Week 3 (CFU/mL)	Week 4 (CFU/mL)
100C	17.5	5	5	20	5
250C	5	5	0	10	0
350C	10	10	5	0	5

The Total Dissolved Solids (TDS) Test Results

The results derived from the analysis of total dissolved solids (TDS) offer valuable insights into the intrinsic sugar content of the constituent ingredients. The investigation underscores a nuanced pattern, demonstrating nominal fluctuations in the total dissolved solids value throughout the storage period. A minimal decline in TDS values during storage signifies that microbial utilization of sugar is limited, suggesting a restrained microbial presence in the beverage (Kusumawati, 2008). This observation is consistent with the findings obtained from the Total Plate Count (TPC) test conducted in this study, revealing a diminished total microorganism count. Collectively, these findings converge to signify a state of minimal food deterioration, further substantiated by the restrained reduction observed in the total dissolved solids value.

Shelf Life Estimation of Chicken-Herbal Essence

Utilizing the principles of the Arrhenius equation, the data for estimating the shelf life of Chicken-Herbal essence products has been derived, as illustrated in the presented Table 4.

Table 4 delineates the shelf life estimation data, stratified into two comprehensive categories: weeks and days. This dual classification is integral to elucidating the potential impact of escalating storage temperatures on the expeditious degradation of product quality within abbreviated temporal intervals. The results within Table 4 elucidate a conspicuous pattern, indicating a notable inverse relationship between higher storage temperatures and reduced estimated shelf life durations. This observed trend harmonizes with the research conducted by Rusli et al. (2022), wherein the storage of ginger latte products at 45°C exhibited a discernibly hastened rate of deterioration compared to the lower storage temperature of 35°C.

The examination of two pivotal parameters, pH and TPN, as delineated in Table 4, elucidates a distinctive pattern wherein the pH parameter exhibits a more rapid decline, signifying a swifter compromise in shelf life quality. This observed phenomenon may be attributed to enzymatic reactions inherent in the product. Consequently, applying the Arrhenius model to estimate the shelf life of Chicken-Herb essence across three distinct temperatures reveals respective durations of 7.5, 3.8, and 4.6 weeks.

In contrast, the TPN parameters suggest a relatively prolonged estimated shelf life. This disparity can be attributed to a post-packaging pasteurization process aimed at eliminating potential microbial contaminants introduced during the packaging phase, contributing to an enhanced preservation of product integrity.

Sensory Attributes Test Results

Sensory evaluations were conducted on the chicken-herbal essence product following a storage duration of 6 weeks. The primary objective of this assessment was to ascertain the acceptability of the chicken-herbal essence among panelists after

Table 2. Total Dissolved Solids of Chicken-Herb Essence in 4 Weeks Storage

Time Temp.	Week 0 (%Brix)	Week 1 (%Brix)	Week 2 (%Brix)	Week 3 (%Brix)	Week 4 (%Brix)
10°C	27,450	27,270	27,370	27,230	27,270
25°C	27,350	27,310	27,150	27,310	27,270
35°C	27,383	27,383	27,100	27,383	27,310

Table 4. Shelf Life Estimation of Chicken-Herbal Essence using the Arrhenius Model

Parameter	Shelf life (weeks)			Shelf life (days)		
	10°C	25°C	35°C	10°C	25°C	35°C
pH	7,5268	3,8825	4,6119	52,6877	27,1776	32,2834
TPN	19,8285	9,5951	7,8852	138,7996	67,1656	55,1963

Note: TPN=Total Plate Numbers

the specified storage period. The ensuing outcomes derived from the sensory test are comprehensively presented in the subsequent table for detailed examination and analysis.

As delineated in the table, panelists consistently rated the acceptability of chicken-herbal essence from 5.3 to 6.1 on the scale from the first to the fourth week, maintaining overall acceptance with marginal variations. However, from the fifth week onwards, a more noticeable decline in acceptability surfaced, though not universally across all products. Consequently, storing chicken-herbal essence for six weeks remains generally acceptable, albeit with a perceptible reduction in overall acceptability during the latter weeks of storage.

Analyzing the scale range in the sensory test, the initiation of acceptability decline is discerned at a rating of 4. Utilizing overall acceptability as the basis, calculations were conducted to determine the onset of shelf life deterioration through regression analysis of this dataset. The resultant regression equation indicates that the shelf life, when stored in an open room at a temperature of 30°C based on sensory assessments, is estimated to be 22.935 weeks or approximately 22 weeks, as illustrated in Figure 2.

This research holds the merit of employing the Arrhenius model for accurate shelf life estimation, providing proximity to actual shelf life values. The utilization of this model stands out for its efficiency, reducing both time and cost implications in comparison to conventional methods involving actual storage conditions for shelf life determination.

The choice of pasteurization as the sterilization method in this study presents an avenue for exploring alternative sterilization techniques with potential extensions to shelf life. Additionally, it is noteworthy that not all parameters for shelf life estimation were comprehensively addressed in this research.

CONCLUSION

Chicken-herbal essence underwent storage at three distinct temperatures, revealing a notable decline in quality across the stored samples. Utilizing the Arrhenius model, the estimated shelf life for chicken-herbal essence stored at 25°C is calculated to be approximately 3.88 weeks, indicative of the temporal span before a significant degradation in product attributes is anticipated. The implications drawn from this research underscore the necessity for further investigations incorporating additional parameters, notably water content. Moreover, the study recommends the

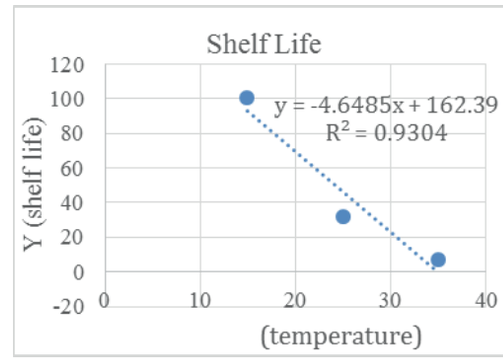

Figure 2. Shelf Life Estimation based on Sensory Test

Tabel 6. Sensory Attributes Property test of Chicken-herbal Essence in 6 weeks of storage

Week -	Color /Visual			Texture / Thickness			Aroma			Taste			Overall Acceptance		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
1	6.3	6.0	5.9	6.1	6.2	6.1	5.9	6.1	5.7	6.1	6.0	5.9	6.1	6.0	5.9
2	5.7	6.4	5.6	5.9	6.1	5.9	5.5	6.0	5.9	5.7	6.0	5.7	5.8	6.1	5.8
3	6.2	6.2	5.6	6.2	6.2	5.6	5.8	5.9	5.0	5.8	6.2	4.9	6.0	6.1	5.3
4	6.1	6.2	6.1	6.0	5.8	5.9	5.5	5.6	5.5	5.5	5.4	5.5	5.8	5.6	5.7
5	5.4	5.1	6.2	5.8	5.3	5.9	5.4	3.6	5.4	5.3	3.2	5.3	5.2	3.9	5.6
6	5.3	6.1	5.1	5.7	6.0	5.1	5.6	5.9	3.0	5.4	5.7	3.1	5.5	6.0	3.5

Note: A = Chicken-herbal essence product stored at 15°C, B = Chicken-herbal essence product stored at 25-27°C, C = Chicken-herbal essence product stored at 35°C

exploration of alternative methods for estimating shelf life.

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REFERENCES

Anagari H., Mustaniroh S. A., Wignyanto. (2011). Penentuan umur simpan minuman fungsional sari akar alang-alang dengan metode accelerated shelf life testing (ASLT) (studi kasus di UKM "R.Rovit" Batu-Malang). *Agrointek,* 5(2):118-125.

Asiah, N., Cempaka, L., & David, W. (2018). Pendugaan Umur Simpan Produk Pangan. In *UB Press*.

[BSN] Badan Standardisasi Nasional. 2015. SNI ISO 4833-1:2015 Tentang Standar Nasional Indonesia Mikrobiologi Rantai Pangan - Metode Horizontal untuk Enumerasi Mikroorganisme - Bagian 1: Penghitungan Koloni pada Suhu 30^0C dengan Teknik Cawan Tuang. Badan Standardisasi Nasional. Jakarta.

Chao J. C-J., Tseng H-P., Chang C. W., Chien Y-Y., Au H. K., Chen J-R., Chen C-F. (2004). Chicken extract affects colostrum protein compositions in lactating women. *J Nutr Biochem*. 15(1):37–44.

Devianti, R. P., Soetarto, E. S., & Hendarto, K. A. (2015). *Composition And Content Of Bacteria In Trigona sp Honey And Antimicrobial Activity Of Microbial Pathogens*. 66–67. Retrieved from http://etd.repository.ugm.ac.id/

Herawati, H. (2008). Penentuan umur simpan pada produk pangan. *Jurnal Litbang Pertanian*, *27*(4), 124–130.

Khutami, C., Sumiwi, S. A., Khairul Ikram, N. K., & Muchtaridi, M. (2022). The Effects of Antioxidants from Natural Products on Obesity, Dyslipidemia, Diabetes and Their Molecular Signaling Mechanism. *International Journal of Molecular Sciences*, *23*(4). https://doi.org/10.3390/ijms23042056

Kusnandar, F. (2010). Kimia Pangan. Komponen Pangan. PT. Dian Rakyat. Jakarta

Kusnandar, F., Adawiyah, D. R., & Fitria, M. (2010). Pendugaan umur simpan biskuit dengan metode akselerasi berdasarkan pendekatan kadar air kritis. *Jurnal Teknologi Dan Industri Pangan*, *XXI*(2), 1–6.

Kusumawati, riska prata. (2008). *Skripsi pengaruh penambahan asam sitrat dan pewarna alami kayu secang (*. IPB Bogor.

Li, Y. F., He R. R., Tsoi B., Kurihara H. (2012). Bioactivities of Chicken Essence. Journal of Food Science 77(4): 105 – 110

Lakshminarayan, S. M., Rathinam, V., & KrishnaRau, L. (2006). Effect of maltodextrin and emulsifiers on the viscosity of cake batter and on the quality of cakes. *Journal of the Science of Food and Agriculture*, *86*(5), 706–712.

Meilgaard, M. C., Carr, B. T., & Civille, G. V. (1999). *Sensory evaluation techniques*. CRC press.

[PerBPOM] Peraturan Badan Pengawas Obat dan Makanan. 2019. PerBPOM No 13 Tahun 2019 Tentang Batas Maksimal Cemaran Mikroba dalam Olahan Pangan. Badan Pengawas Obat dan Makanan. Jakarta.

Rusli M. S., Nuryanti A., Fitria R.,Budiani A. R., Fiprina N. F. (2022). Pendugaan Umur Simpan Produk Minuman Ginger Latte Menggunakan Model Arrhenius. *Jurnal Teknologi Industri Pertanian,* 32 (2): 188-196. https://doi.org/10.24961/j.tek.ind.pert.2022.32.2.188

Sulaeman, A., Puspasari, E., Palupi E., & Rachman, M. J. (2022). Karakteristik Organoleptik dan Komposisi Zat Gizi Minuman Chicken Essence yang Dibuat dengan Pressure Cooking. *Gizi Indon*, 45(1):1-10

Suwita, I. K., Kristianto, Y., dan Purwaningsih, F. Y. (2013). *Pendugaan Umur Simpan Sirup Temulawak (Curcuma xanthorrhiza Roxb), Madu dan Ekstrak Ikan Gabus (Ophiocephalus striatus) dengan Model Arrhenius dan Model Q10*. *Jurnal Agromix*, 2(2) , 18–35.

Wahyudi, A., & Dewi, R. (2017). Upaya Perbaikan Kualitas dan Produksi Buah Menggunakan Teknologi Budidaya Sistem "ToPAS" Pada 12 Varietas Semangka Hibrida. *Jurnal Penelitian Pertanian Terapan*, *17*(1), 17–25.