PAPER • **OPEN ACCESS**

The effect of giving chia seeds on the bodyweight of pregnant mice (Mus Musculus L.)

To cite this article: R Uthia and I O Rz 2022 *IOP Conf. Ser.: Earth Environ. Sci.* **1041** 012026

The effect of giving chia seeds on the bodyweight of pregnant mice (Mus Musculus L.)

R Uthia*, I O Rz

Politeknik Kesehatan Kemenkes Riau, Pekanbaru, Indonesia

*rahimatul1089@gmail.com; ira@pkr.ac.id

Abstract. Chia seeds (Salvia hispanica L.) are becoming a trend for consumption by employees of the Health Ministry Polytechnic of Riau. This support by many studies on the benefits of consuming these seeds for a diet to lose weight or maintain ideal body weight. Several studies also reported that Chia seeds lower and maintain blood cholesterol levels. This study was to see the effect of giving Chia seeds on the body weight of pregnant mice. This research use laboratory experimental methods, which is analogous to the condition of pregnant women on mice. Chia seeds are administrating into three groups of 4 g; 8 g; 16 g and compared to one control group. The administration starts on the 6th to 15th day of pregnancy. Bodyweights measured at the beginning of pregnancy until before parturition. The results showed that giving Chia seeds did not affect the weight gain of pregnant mice (P>0.05). So from this study concluded that giving Chia seeds does not affect body weight in pregnant mice.

1. Introduction

Chia seeds (Salvia hispanica L.) are becoming a trend for consumption by employees of the Health Polytechnic of the Ministry of Health of Riau. Many studies about the benefits of consuming these seeds to lose weight or maintain ideal body weight. Several studies have reported that chia seeds can lower and maintain blood cholesterol levels [1] and have a weight loss effect in obese people [2]. Chia seed can reduce the risk of cardiovascular disease, inflammation, central nervous system disorders, and diabetes [3] thus making people enthusiastic about consuming it to get an ideal body weight. This article is a fraction of the author's research entitled The Effect of Chia Seeds on The Development of The Fetus of Mice (Mus musculus L.).

Chia seeds are natural ingredients with health potential, which use as an alternative for developing functional food products. This plant is native to Central America, specifically Mexico and Guatemala. Chia seeds contain protein (15–25 percent), fat (30–33 percent), carbohydrates (26–41 percent), fiber (18–30 percent), and minerals (4–5 percent) [4]. Chia seeds also contain omega-3 fatty acids (linolenic acid) by 17.83 percent [5]. In 2009 chia seeds were approved as a novel food source by the European Parliament and the Council of Europe. The use of chia seeds as a food ingredient report being safe because it has no side effects or allergenicity [6].

Thus, chia seeds and their derivatives are promising sources for development. Chia seeds contain 17.83% omega-3 fatty acids (-linolenic acid) [5] and are a source of dietary fiber, protein with high biological value, and antioxidants [7]. In addition to containing essential fatty acids, chia seeds also report containing phenolic compounds. These phenolic compounds are bioactive components that contribute to the health benefits of chia seeds. The phenolic components in chia seeds are flavanols and

phenolic acids (myricetin, quercetin, kaempferol, caffeic acid [8]. These compounds are primary and synergistic antioxidants that provide a high proportion of antioxidant activity of chia seeds [9].

Caffeic acid and chlorogenic acid found in chia seeds showed protection to cells from free radicals and inhibition of lipid peroxidation. It was signified stronger than vitamin C protection, ferulic acid, and vitamin E. Chia seeds are also high in dietary fiber and protein, rich in many exogenous amino acids. This grain is also a good source of minerals and vitamins as bioactive compounds with high antioxidant activity, especially polyphenols and tocopherols [10].

2. Methodology

This study used an experimental design using mice as test animals consist of four treatment groups (control, dose 4 g, dose 8 g, and dose 16 g). The parameter to be observed is the mother's weight during pregnancy. The study began by characterizing the test preparations, including organoleptic observations, measurement of water content, ash, carbohydrates, total fat, protein, Ca, Fe, P, Zn, crude fiber, Mg, and K. The steps for testing are as follows:

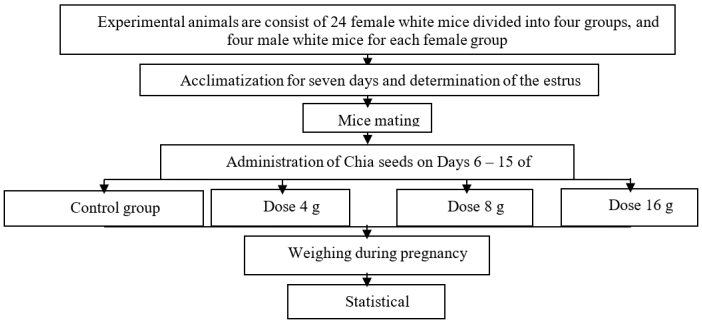


Figure 1. Working Scheme of Observing the Effect of Chia Seed on Pregnant Mice Body Weight

2.1 Dosage Determination

Chia seeds administered to experimental animals were 4, 8, and 16 g per daily given orally.

2.2 Preparation of experimental animals

Animals used in this experiment were female mice aged about three months, never treated with drugs, and body weight ranged from 20-30 grams. Mice were acclimatized for seven days to get the animals used to the experimental environment. The feeds gave as *ad libitum, t*he body weight was measured every day, and the behavior observes daily. The estrus period determines visually by observing the mice's vagina during acclimatization. The mice during estrus marks by the red and gummy vagina of the mice. Animals used are considered healthy if the change in body weight is not more than 10%, visually shows normal behavior, and has an estrus cycle of 4-5 days [11].

2.3 Grouping of experimental animals

Mice divide into four groups, where one group consists of 6 female mice and one male mouse.

2.4 Animal mating

At the next stage during estrus, animals are mated with a ratio of males and females of 1:6. Male white mice were put into female cages at four in the afternoon and separated in the morning. The vaginal plug examine. Vaginal plugs indicate that the mice have copulated and are on the 0th day of gestation. The pregnant mice were separated, unmarried mice were mate again with male mice [12][13].

2.5 Administration of chia seed

The test preparations in three dose variants were given orally for ten consecutive days starting from the 6th to the 15th day of gestation. The weighing takes every day for 18 days of observation. If there is a drastic weight loss and accompanied by bleeding around the vagina, the mice may have suffered a miscarriage or aborted (excluded). It noted that mice were sick due to treatment (also excluded [14].

3. Result and Discussion

Table 1. Organoleptic of Chia

Parameters	Flour Organoleptic	Seeds Organoleptic
Form	Fine powder, coarse fibrous	Small round, slippery
Color	Dark-brown	Dark-brown
Flavor	Tasteless	tasteless
Smell	Smelly	unsmelly

Table 2. Characteristics of Chia flour

Parameters	%	Analysis Method
Water content	3.09	SNI 01-2891-1992,9
Ash Level	4.59	SNI 01-2891-1992,8.2
Carbohydrate	8.47	SNI 01-2891-1992,7.1
Total fat	24.5	SNI 01-2896-1998,5
Protein	23.9	SNI 01-2896-1998,5
Ca	1.57×10^{-1}	AOAC Official method 986, 24
Fe	6.36×10^{-2}	SNI 01-2896-1998,5
P	1.34×10^{-1}	SNI 01-2891-1992,11
Zn	5.59×10^{-3}	SNI 01-2896-1998,5
Coarse Fiber	44.1	SNI 01-2896-1998,5
Mg	3.7×10^{-1}	SNI 01-2891-1992,5.1
K	7.8×10^{-1}	SNI 01-2891-1992,6.1

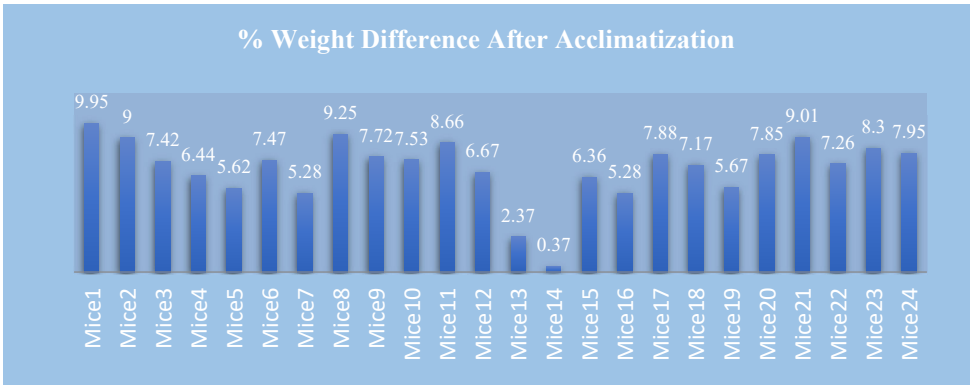


Figure 2. % Weight Difference after Acclimatization

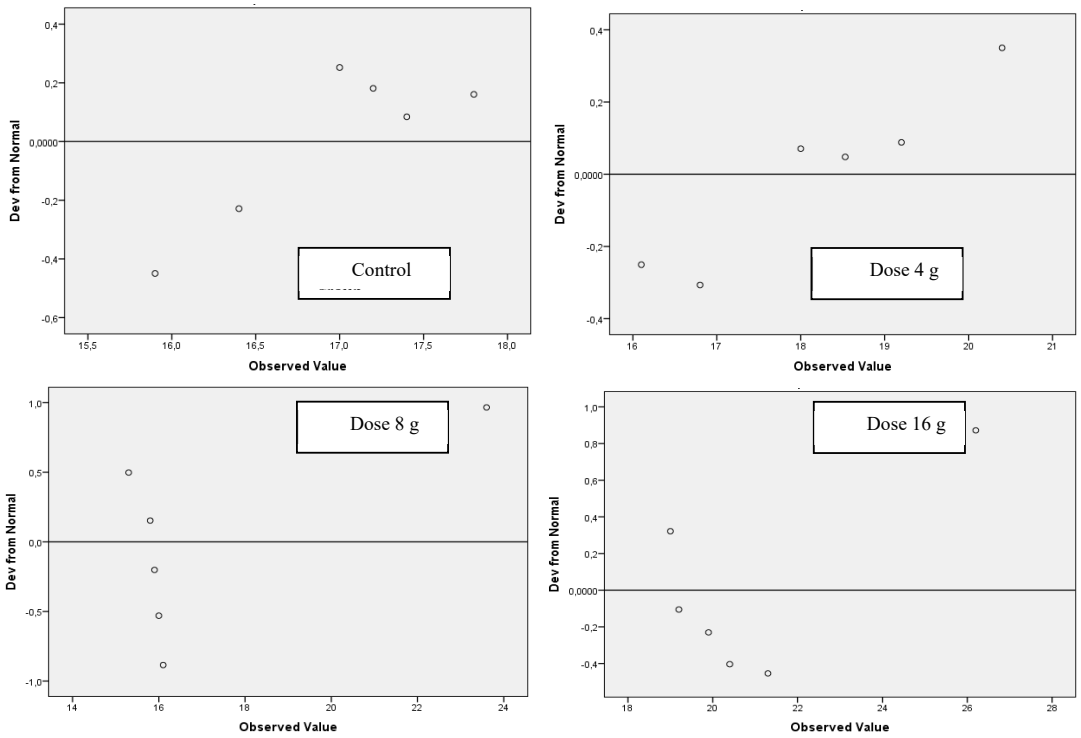


Figure 3. Broodstock Average Weight Gain

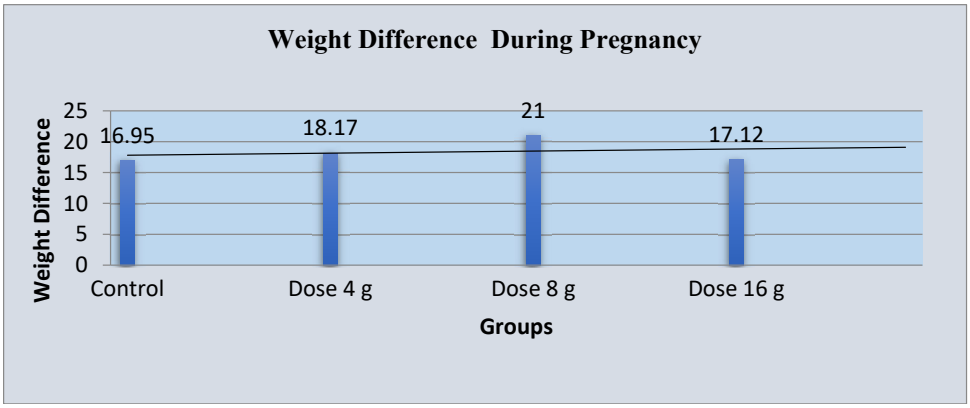


Figure 4. Weight Difference During Pregnancy

There are organoleptic differences in flour and seeds of Chia, namely in the smell. Chia seed flour has a slight odor. One of the distinctive characteristics of chia seeds is their ability to form a gel layer. This gel layer formed after the seed hydrate with water. On contact with water, the outer epidermis of the seed ruptures and releases gum filament absorbs water immediately, and the gel layer looks like a transparent capsule.

The transparent capsule secretes where this gum retains and absorbs water, can even give different viscosities to any given concentration of chia seeds. Chia seed gum absorbs the water up to 12 times its dry weight. Dry gum obtained from the extraction of chia seed gum reports absorbs the water up to 27

times [15]. The smell of the flour may release during flour processing. The organoleptic of Chia show in table 1.

Chia seed gum has a hydration process that is almost the same as xanthan gum. Both require time and a certain way for the swelling process they dispersed in solution homogeneously. However, chia seeds and xanthan gum have different visual appearances of dispersion. In chia seeds, the gum dispersion shows from the chia seeds spread evenly in the solution, while xanthan gum does not exist [16]. This is the reason why the administration route of chia is eaten by the mice directly. And the Characteristics of Chia flour are shown in table 2.

Table 2 shows that Chia seeds contain macro and micronutrients needed by pregnant women, including carbohydrates, protein, fat, calcium, iron, phosphorus, zinc, fiber, magnesium, and potassium. In addition to good nutritional value, chia seeds also have a low level of allergenicity and are also food with a safe category to use. These seeds gave as additional food for pregnant women [6].

No testing animals after acclimatization for seven days experienced weight gain and loss exceeding 10 %, and no testing animals were sick and could be used for research, as shown in Figure 2. Acclimatization is the maintenance of experimental animals to adapt to a new environment [17]. The length of acclimatization varied from 3-14 days, but most researchers acclimatized for seven days. Acclimatization also prevents stress on animals in a new environment [18]. During the acclimatization period, animals adjust to a new environment hoped that animals will no longer stress because of moving from their previous cage.

Basically, during pregnancy, the brood stock will experience weight gain as gestational age increases. A study stated that maternal weight gain during pregnancy is directly related to the baby's weight [19]. Based on the theory, pregnancy causes increased metabolism of energy and other nutrients. Fetal growth and development increased energy and nutrients. The increasing size of the uterine organs changes the composition and metabolism of the mother. The nutritional status of pregnant women determines the weight of babies born; the nutritional adequacy of pregnant women see from their weight gain during pregnancy [20].

In this study, the body weight of pregnant mice measures during pregnancy. The average weight gain of mice before parturition can be seen in Figure 3. It shows that in each dose group of chia seeds, the bloodstock experienced weight gain during pregnancy, including the control group. This indicates that the pregnancy is healthily taking place and hoped that the foetus is also in top condition. Weight gain occurred in all treatment groups, indicating that the provision of Chia seeds did not affect the weight of pregnant women ($p>0.05$). The same thing is also clarified in figure 4, the difference in maternal weight during pregnancy.

Figure 4 sees that the difference in maternal weight gain in each treatment group includes the control group. If a straight line draws, it shows that the weight gain of the parent during pregnancy appears linear, or there is no difference in the weight gain of the parent when given chia seeds or not given chia seeds. The data processing using ANOVA also showed no effect of giving chia seeds to the bodyweight of the parent ($p>0.05$). Nieman's hypothesis states that high dietary fiber and ALA content in chia seeds can reduce body weight, risk of heart disease, and obesity.

However, the results of clinical trials of chia seeds in humans found that increasing plasma ALA levels did not cause significant weight loss [21]. It proves from this research that giving chia seeds to pregnant mice did not have a weight-lowering effect. The bodyweight of the bloodstock in all treatment groups increased.

4. Conclusion

Giving chia seeds during pregnancy (in the study to mice) did not affect body weight, meaning that the mice continued to gain weight which was no different from the control group.

Acknowledgment

Thank you to the Health Ministry Polytechnic of Riau for research funding so that this research can run smoothly.

References

[1] Ayerza R, Coates W. 2007. Effect of dietary a-linolenic fatty acid derived from chia when fed as ground seed, whole seed an oil on lipid content and fatty acid composition of rat plasma. Ann Nutr Metab. 51 (1): 27-34
[2] Brissette CE, Jenkis AL, Choleva L, Vuksan V. 2013. Abstract. The effect of Salvia hispanica L seeds on weight lost in everweight anda obese individuals with type 2 diabetes mellitus. Can J Diabetes. 37(4): 64
[3] Vuksan V, Whitman D, Siepenviver J, Jenkis A, Rogovik A, Bazinet R, Vidgen E, Hanna A. 2007. Supplementation of conventional therapy with the novel grain Salba (Salvia hispanica L) improves major and emerging cardiovascular risk factors in type 2 diabetes. Diabetes care 30(11): 2804-2810
[4] Ixtaina, V.Y., S.M. Nolasco, dan M.C. Tom. 2008. Physical Properties of Chia (Salvia hispanica L.) Seeds. Industrial Crops and Product. Vol. 28(3): 286–293.
[5] [USDA] United States Department of Agriculture. 2011. National Nutrient Database for standard reference. Release 24. Nutrient data Laboratory Home Page, U.S. Dpeartment of Agriculture Research Service
[6] EFSA. 2009. Scientific Opinion of the Panel on Dietetic Products Nutrition and Allergies on a Request From The European Commission on The Safety of 'Chia seed (Salvia hispanica) and Ground Whole Chia Seed' as a Food Ingredient.The EFS Journal.Vol. 996: 1-2.
[7] Craig R. 2004. Application for approval of whole chia (Salvia hispanica L) seed and ground while seed as novel food ingredient. UK:ACNFP
[8] Ali, N.M., S.K. Yeap, W.Y. Ho, B.K. Beh, S.W. Tan, dan S.G. Tan. 2012. The promising future of chia, Salvia hispanica L. Journal of Biomedicine and Biotechnology. doi: 10.1155/2012/171956
[9] Fernandez I, Ayerza R, Coates W, Vidueros SM, Slobodianik N, Pallaro AN. 2006. Nutritional characteristis of chia. Actualizacion en Nutricion. 7: 23-25
[10] Reyes CE, Tecante A, Valdivia Mal. 2008. Dietary fiber content and antioxidant activity of phenolic compund present in Mexicam chia (Salvia hispanica L) seed, Food Chemc. 107(2): 656-663
[11] Almahdy, A. 2012. Teratologi Eksperimental. Padang: Andalas UniversityPress.
[12] Almahdy, A. 2011. Uji aktivitas vitamin A terhadap efek teratogen warfarin pada fetus mencit putih. Medan: USU Press.
[13] Kauffman, M. H. 1992. The atlas of Mouse Development. London: Academic Press Limited
[14] Lu, F.C. 1995. Toksikologi Dasar (Edisi kedua). Penerjemaah: E. Nugroho. Jakarta: Universitas Indonesia Press.
[15] Hernandez, L.M. 2012. Gum Form Chia Seeds (Salvia hispanica): Microstructure, Physico-Chemical Characterization and Application in Food Industry. PhD Thesis of Pontificia Universidad Catolica de Chile, 120h.
[16] Campos, M.R., N.C. Solis, G.R. Rubio, L.C. Guerrero, dan D.B. Ancona. 2014. Chemical and Functional Properties of Chia Seed (Salvia hispanica L.) Gum. Mexico. International Journal of Food Science.
[17] Hasanah A. 2017. Efek jus bawang bombay (Allium cepa Linn.) terhadap motilitas spermatozoa mencit yang diinduksi Streptozotocin (STZ). Saintika Medika 11(2): 92-101.
[18] Purwantono P, Kusrini MD, Masy'ud B. 2016. Manajemen penangkaran empat jenis kura-kura peliharaan dan konsumsi di Indonesia. Jurnal Penelitian Hutan dan Konservasi Alam 13(2): 119-135.
[19] Khoiriah, F., Angraini, D. I., Carolina. N., & Sukohar, A. 2015. Hubungan Pertambahan Berat Badan Ibu Selama Hamil Dengan Berat Bayi Lahir Rendah. J Majority. Vol.4(3):52-57
[20] Nadesul, H. 2008. Makanan Sehat Untuk Ibu Hamil. Puspa Swara. Jakarta.
[21] Nieman, D.C., E.J. Cayea, M.D. Austin, D.A. Henson, S.R. McAnult, dan F. Jin. 2009. Chia seed does not promote weight loss or alter disease risk factors in overweight adults. Nutrition Research.

Vol. 29(6): 414–418.

LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEERREVIEW
KARYA ILMIAH : JURNAL ILMIAH*

Judul Jurnal Ilmiah (Artikel)	: The effect of giving chia seeds on the bodyweight of pregnant mice *(Mus Musculus L.)*
Penulis	: Rahimatul Uthia, Ira Oktaviani Rz
Jumlah penulis	: 2
Status Pengusul	: Penulis Pertama/ ~~Penulis Kedua~~/ Penulis Korespondensi**
Identitas Jurnal Ilmiah	:
a. Nama Jurnal	: IOP Conference Series: Earth and Environmental Science
b. Nomor ISSN	: 1755-1315
c. Volume, Nomor, bulan, tahun	: Vol 1041, No 1, Juni 2022
d. Penerbit	: IOP Publishing
e. DOI artikel	: 10.1088/1755-1315/1041/1/012026
f. Alamat web Jurnal	: https://iopscience.iop.org/article/10.1088/1755-1315/1041/1/012026
g. Terindek di Scimagojr/ Thomson Reuter ISI Knowledge atau di –	: Scopus Q4

Kategori publikasi jurnal ilmiah (beri kategori pada yang tepat)	V	: Jurnal Ilmiah Internasional Bereputasi
		: Jurnal Ilmiah Nasional Terakreditasi
		: Jurnal Ilmiah Nasional Tidak Terakreditasi
		: Jurnal Ilmiah Nasional terindeks di DOAJ, CABI, COPERNICUS dan lainnya

Hasil Penilaian Peer Review :

Komponen yang Dinilai	Nilai Maksimal Jurnal Ilmiah = 40 a.k					Nilai Akhir yang Diperoleh
	Internasional Bereputasi	Internasional	Nasional Terakreditasi	Nasional Tidak Terakreditasi	Nasional Terindek	
	Maks:	Maks:	Maks:	Maks:	Maks:	
a. Kelengkapan unsur isi artikel (10%)	35					3.5
b. Ruang lingkup dankedalaman pembahasan (30%)	37					11.1
c. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	38					11.4
d. Kelengkapan unsur dan kualitas terbitan/jurnal (30%)	38					11.4
Total = (100%)						37.4
Nilai Pengusul = 60 % x 37.4 = 22.44						

Komentar *Peer Peviewer* :

1. Tentang kelengkapan dan kesesuaian unsur:

   Kelengkapan dan unsur dari artikel yang dipublikasikan pada IOP Conference Series: Earth and Environmental Science sudah memenuhi dan dinilai cukup lengkap.

2. Tentang ruang lingkup dan kedalaman pembahasan:

   Ruang lingkup dan pembahasan dari artikel yang diajukan cukup mendalam dan mudah dipahami oleh audience.

3. Kecukupan dan kemutahkiran data serta metodologi:

   Metodologi yang digunakan dalam penelitian yang berjudul "The effect of giving chia seeds on the bodyweight of pregnant mice (*Mus Musculus* L.)" sudah mumpuni namun perlu ditingkatkan lagi menggunakan metode yang *up to date*

4. Kelengkapan unsur kualitas penerbit :

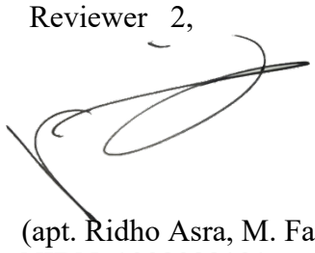
   Kualitas penerbit baik, terindeks di Scimagojr pada scopus Q4

5. Kesesuaian bidang ilmu :

   Riset yang dilakukan sesuai dengan bidang ilmu peneliti.

Birmingham, 13 Januari 2022

Reviewer 2,



(apt. Ridho Asra, M. Farm.)
NIDN. 1009099101
Jabatan Fungsional: Lektor / IIId
Unit Kerja: Sekolah Tinggi Ilmu Farmasi Padang

*Dinilai oleh 2 reviewer secara terpisah

**Coret yang tidak perlu

LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEERREVIEW
KARYA ILMIAH : JURNAL ILMIAH*

Judul Jurnal Ilmiah (Artikel) : The effect of giving chia seeds on the bodyweight of pregnant mice *(Mus Musculus L.)*

Penulis : Rahimatul Uthia, Ira Oktaviani Rz

Jumlah penulis : 2

Status Pengusul : Penulis Pertama/ ~~Penulis Kedua~~/ Penulis Korespondensi**

Identitas Jurnal Ilmiah :

a. Nama Jurnal : IOP Conference Series: Earth and Environmental Science
b. Nomor ISSN : 1755-1315
c. Volume, Nomor, bulan, tahun : Vol 1041, No 1, Juni 2022
d. Penerbit : IOP Publishing
e. DOI artikel : 10.1088/1755-1315/1041/1/012026
f. Alamat web Jurnal : https://iopscience.iop.org/article/10.1088/1755-1315/1041/1/012026
g. Terindek di Scimagojr/ Thomson Reuter ISI Knowledge atau di – : Scopus Q4

Kategori publikasi jurnal ilmiah (beri kategori pada yang tepat)
[V] : Jurnal Ilmiah Internasional Bereputasi
[ ] : Jurnal Ilmiah Nasional Terakreditasi
[ ] : Jurnal Ilmiah Nasional Tidak Terakreditasi
[ ] : Jurnal Ilmiah Nasional terindeks di DOAJ, CABI, COPERNICUS dan lainnya

Hasil Penilaian Peer Review :

Komponen yang Dinilai	Nilai Maksimal Jurnal Ilmiah = 40 a.k					Nilai Akhir yang Diperoleh
	Internasional Bereputasi	Internasional	Nasional Terakreditasi	Nasional Tidak Terakreditasi	Nasional Terindek	
	Maks:	Maks:	Maks:	Maks:	Maks:	
a. Kelengkapan unsur isi artikel (10%)	39.5					3.95
b. Ruang lingkup dankedalaman pembahasan (30%)	39.5					11.85
c. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	39.5					11.85
d. Kelengkapan unsur dan kualitas terbitan/jurnal (30%)	39.5					11.85
Total = (100%)						39.5
Nilai Pengusul =						39.5

Komentar *Peer Peviewer* :

1. Tentang kelengkapan dan kesesuaian unsur:
   Penulis telah menulis artikel dengan baik sesuai kelengkapan unsur artikel. Semoga ke depan penulis dapat menulis lebih baik lagi.

2. Tentang ruang lingkup dan kedalaman pembahasan:
   Pembahasan telah ditulis dengan baik oleh penulis.

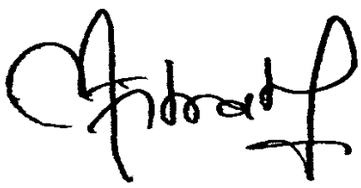
3. Kecukupan dan kemutahkiran data serta metodologi:
   Metodologi yang dilaksanakan oleh penulis baik.

4. Kelengkapan unsur kualitas penerbit :
   Artikel dan terbitan jurnal baik.

5. Kesesuaian bidang ilmu :
   Bidang ilmu sesuai .

Padang, 7 Januari 2022

Reviewer 2,



(apt. Fitra Fauziah, M.Farm)
NIDN. 1019078603
Unit Kerja: Sekolah Tinggi Ilmu Farmasi Padang
Jabatan Akademik: Lektor

*Dinilai oleh 2 reviewer secara terpisah

**Coret yang tidak perlu