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Test the Digestibility Feed with Addition of Chicken Feather Meal Fermented by Fungus Isolates from Soil Chicken Cage

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Abstract : Chicken feather meal from waste chicken feathers. Chicken feather is a waste from a Chicken Piece House (RPA). Chicken feather waste have the potential to be used because have a high protein content of 80-90%. But waste chicken feathers have a low digestibility because it contains 8.8% of the keratin protein content. The use of chicken feather meal as animal feed in this study should be through touch fermentation technology with fungus isolates from soil chicken cage. The aim of this study was to test the digestibility feed with the addition of chicken feather meal fermented by fungus isolates from soil chicken cage. This research was carried out by isolating the fungus from soil chicken cage to get a fungus isolates from soil chicken cage capable of degrading keratin in the chicken feather. Fungus isolates obtained are used to fermentation chicken feather meal and then analyzed the protein content after fermentation. Chicken feather protein content after fermentation was tested using a completely randomized design (CRD) non factorial with 4 treatments and 3 ulangan. Chicken feather meal that has been fermented with some fungus isolates from soil chicken cage used as broiler chicken feed and chicken growth measurement (feed consumption, body weight gain and feed conversion) and feed digestibility coefficients. The results of research showed that fungus isolate from soil chicken cage better able to increase the protein content of chicken feather meal after fermentation is a fungus isolate inoculum *Penicillium sp* with as much as 3% with a chicken feather meal protein content of 90.90 %%, the growth of broiler chickens (feed consumption amounting to 415.6 gr / head / week, body weight gain of 230, 75 gr / head / week and feed conversion of 1.8) and feed digestibility coefficient of 28, 89%.
Key words : Test the Digestibility Feed, Fungus Isolate Soil Chicken Cage, Chicken Feather Meal

Introduction

Livestock population from year to year increase but has not been able to keep pace with demand for meat consumption is mainly produced by livestock meat. When viewed from the local potential and existing natural resources, the growth of the livestock population can still be improved. The goal population of broiler chickens in North Sumatra province to 2007, there were 58,212,381 tail with the target as many as 52 530 tons of meat production (Siregar, 2004).

To improve the livestock industry and in keeping with preservation of the environment, the need for handling the impact of waste chicken feathers. One alternative is to do is take advantage of waste chicken feathers as a non-conventional source of protein feed for broiler chickens. In the livestock feed industry is very important because it absorbs 60-80% of the cost of production (Anggorodi, 1995). Efforts to reduce the cost of feed is by utilizing waste chicken feathers as a non-conventional feed ingredients. The non-conventional feed ingredients have a low economic value, not compete with humans and are available continuously

Chicken feathers is waste that still has the potential to be used, because it still contains a very high protein nutrition. Chicken feathers has a crude protein content of 80 to 91% of dry matter, crude protein content exceeding soybean meal (42.5%) and fish meal (66.2%) (Adiati and Puastuti, 2004).

Waste chicken feathers also has the disadvantage of a low level of digestibility for their keratin protein or fibrous (fiber) that are difficult to digest. Chicken feather keratin containing 8.8% of the protein content (Scott *et al.,* 1982) and the amino acids lysine, methionine, histidine and tryptophan are low (Willams *et al.*, 1991).

The use of waste as animal feed must be through the handling and further processing or the need for touch technology to improve the nutritional value of the feed material, because it has a low digestibility (Zamora *et al.*, 1989). In this study, treatment of waste chicken feathers with the use of fermentation technology using fungus isolates from soil chicken cage.

Materials and methods

Material

Soil chicken cage as much as 20 gr, Potato handed Agar (PDA) with a composition of 39 gr of medium PDA (Oxoid) in 1 liter of distilled water (distilled water), waste chicken feathers, distilled water is sterile, broiler chickens aged 4 weeks as many as 12 tails, coconut meal, corn bran, soybean meal, fish meal, lime, vegetable oil, vitamins, medicines, rodalon and cattle by 12 plot size of 1 mx 1 mx 0.5 m.

Isolation Soil Chicken Cage

The method according to Cappuccino and Sherman, (1996), the insulation is done by mixing the soil as much as 20 gr in 200 ml distilled water, then shaken with sheker approximately 10 minutes. 1 ml suspension of soil particles are dissolved in 9 ml of sterile distilled water, then shaken until homogeneous in order to obtain dilution 10^{-1}. Furthermore 10^{-2} dilution created by taking a 1 ml suspension of soil particles at 10^{-1} pangenceran dissolved in 9 ml of distilled water that has been sterilized in order to obtain dilution 10^{-2}. On dilution of 10^{-5}, 10^{-6} and 10^{-7}, respectively - each taken 0.1 ml deployed with a hockey stick on PDA (Potato Dextrose Agar) with a composition of 39 gr of PDA medium (Oxoid) in 1 liter of distilled water and then incubated approximately one week at a temperature of 27 ^{0}C (room temperature) for mold growth. Isolation performed twice.

Purification

The method according to Bibiana, (1994), the purification of fungus carried out by taking 1 choock borrer fungal culture media and then put on a PDA, back incubated at room temperature. After approximately 1 week the results obtained mushrooms purification, there was breeding fungus with fungus removal on PDA (Potato Dextrose Agar). Then identified and the resulting isolation I *Helicomyces sp* fungus.

Culturing the fungus in liquid media such as Potato Dextrose Broth (PDB)

The method according to Bibiana (1994), set 250 gr of potatoes that is clean and cut into pieces and then boiled for 20 minutes then filtered until the resulting filtrate with the addition of 1 liter of distilled water (water distilled water) were sterile. Then the filtrate is added to 20 gr of dextrose, and the filtrate solution was poured into 5 erlenmeyer with each Erlenmeyer containing 200 ml Erlenmeyer water mushroom as much as 5 cox borer or by Bibiana, (1994) spores were 10^{6} cells / ml. Then it is shaken on sheker with a speed of 60 rpm (round pert minutes) for 2 weeks (Atlas, 1997). The purpose shake up is to create oxygen so fishing spores of

the fungus out. Shake up done until the color changes from dextrose filtrate water becomes more turbid than before shaking.

Quantification Spores

The method according to Raul and Jaime (1986), counting the number of fungal spores in the inoculum by means of hemocytometer. Dilution 10^{-1} fungal inoculum taken as 1 ml fungus inoculum placed on the hemocytometer is then closed. Calculated for each individual cell in a group of cells. Included in the calculation of cells located above and left touching the center line on the edge of the square. Counting the number of fungal spores by the formula:

The number of fungal spores = the number of fungal spores in 5 big boxes x50.000= (16 x 5 small box big box) x 50.000= 80 x 50.000 mm^3

Fermentation

The method according to Bibiana (1994), a chicken feather meal as a fermentation medium must contain at least 30% water content to facilitate the growth of fungus. Flour chicken feathers in dry conditions still contains water as much as 10%, so the addition of water of at least 20% of the dry weight of the flour chicken feathers mixed with inoculum mushrooms 1% (v / w), 2% (v / w), and 3% (v / w) of the dry weight of the material. After that just sprayed evenly over the chicken feather meal as much as 20 gr that has been placed in an airtight plastic container so that the fermentation process.

Analysis of Protein Content of Chicken Feather MealAfter Fermentation

The method according to Suhardi *et al.*, (1984), analysis of protein by Kjeldahl method in which the process of destruction that chicken feather meal weighed as much as 0.1 gr of selenium plus as much as 0.1 gr as a catalyst coupled with sulfuric acid, and then burned to white diruang acid. After the distillation process is carried out by accommodating distilled from pumpkin kedal then added distilled water 100 ml plus 35% NaOH approximately 5 ml and then accommodated in Erlenmeyer containing Boric acid (H3BO3 3%) 5 ml distilled water and then added 30 ml. Distilled accommodated approximately up to 150 ml and then titrated with HCl. Calculation formula protein levels were obtained:

$$\% N = \frac{N\ HCl \times 14 \times 100}{Sample\ Weight \times 1000}$$

% Protein = % N X 6.25 (conversion of water content)
Where, N = Nitrogen Levels
14 = Assessment

To determine the protein content of the flour after fermentation used chicken feathers completely randomized design (CRD) non factorial with four treatments and three replications. The treatment under study consists of:

T0 = Chicken feathers meal without fungus inoculum (control)
T1 = Chicken feathers meal with fungus inoculum 1%
T2 = Chicken feathers meal with fungus inoculum 2%
T3 = Chicken feathers meal with fungus inoculum 3%

Variables measured:

The best dose to produce the protein content of the highest feather meal after fermentation

Testing some fungus isolates isolated from ground chicken coop on the growth of chicken

Chicken feather meal of fermented with fungal isolates from soil chicken cage is used as a protein source for broiler chickens. This testing is done during the first week of using 12 broiler chickens aged 4 weeks, because at that age the digestive chicken was perfect and able to digest foods properly. In this test targets to be achieved is the best chicken growth with standard chicken growth which feed consumption, body weight gain and feed conversion. In addition to the analysis of the content of feces protein (chicken manure) to determine

the level of digestibility of the ration fermented using a third type of fungus that is *Helicomyces sp, Penicillium sp* and *Trichoderma sp.*

a. Feed Consumption

Feed consumption is calculated by finding the difference of feed given to food remains and converted into dry matter and expressed in g / head / day. Data is collected once a week.

Feed Consumption = feed Award x (% DM) - residual feed x (% DM)

b. Body Weight Gain

Body weight gain of livestock is obtained from final body weight reduced initial body weight (g) divided by the length of time of observation / maintenance. Weighing of body weight every week.

Body Weight Gain =

Final Body Weight (g) - Initial Body Weight(g)

Old Time Observations

c. Feed Conversion

Feed conversion is obtained by dividing the amount of feed consumed by the dry ingredients with weight gain during maintenance.

Feed conversion = Consumption (g)

Body Weight gain

Feed Digestibility Coefficients

The method according to Tillman *et al.,* (1991), the digestibility coefficient represents the difference between the content of nutrients in livestock rations eaten with feed substances are still present in the feces. Calculation of ration digestibility coefficients calculated by the following formula:

Feed Digestibility Coefficient =

N ration - faecal N x 100%

N ration

Information:
N ration = content of nutrients ration

Stool N = content of nutrients left in the feces.

Results

Fungi isolated from soil chicken cage can be seen in the figure below:

Figure 1.a Isolat Jamur *Penicillium sp*Figure 1.b Isolat Jamur *Trichoderma sp*

Figure 1.c Isolat Jamur *Helicomyces sp*

Quantification Spores of Soil Fungus Isolates Chicken Coop

Results of counting the number of microbial spores of fungus isolates using various fermentation as inoculum in 1 ml suspension fungus can be seen in Table .1 below:

Table 1. Results of counting the number of microbial spores of fungal isolates using a variety of

Type isolates fungus	Results of spores quantification
Helicomyces sp	1.5 x 10^6 spores/ml
Trichoderma sp	2,25 x 10^6 spores/ml
Penicillium sp	2,65 x 10^6 spores/ml

The Based on Tabel.1 above, the total number of microbes highest in the fungus *Penicillium sp* isolates as much as 2.65 x 10^6 spores / ml, isolate *Trichoderma sp* much as 2.25 x 10^6 spores / ml and fungal isolates Helicomyces sp much as 1.5 x 10^6 spores / ml.

The results of the analysis of dry weight loss percentage after fermented chicken feathers meal

The results of analysis dry weight loss percentage after fermented chicken feathers meal to isolate different types of fungus can be seen in Table 2 below:

Table 2. Results of the analysis of the dry weight percentage loss chicken feather meal fermented with various types of fungus isolates

Types of fungus isolates	Weigth after fermentation (g)	Dry weight of percentage (%)	Dry weight of sample (g)	Dry weight of loss percentage(%)
Tanpa Fersentase (Kontrol)	-	98,04*	19,6#	-
Helicomyces sp	21,20	68,50*	14,52	25,92
Trichoderma sp	19,52	68,50*	14,52	25,92
Penicillium sp	18,92	70,64*	13,36	31,84

Note: * = Results of laboratory analysis of nutrition majors FPUSU farm Terrain (2008)
= Dry weight before fermentation

Sample weight = 20 g

Based on analysis of Table 2 above, the percentage of dry weight loss found in chicken feathers fermented with the fungus *Penicillium sp* isolates of 31.84%, isolate *Helicomyces sp* fungus by 25, 92% and *Trichoderma sp* isolates of 25.92%.

The result of biological assay using chicken feather flour fermented with some fungal isolates on the growth of chicken

The result of biological assay using chicken feather fermented with some fungal isolates

on the growth of chickens (feed consumption, body weight gain and feed conversion) can be seen in the following Tabel.3:

Table 3. Results of biological assay using chicken feather fermented with some fungal isolates on the growth of chicken

Types of fungus isolates	Feed consumption (g / head / week)	Body weight gain (g / head / week)	Feed conversion
Helicomyces sp	301,5	150,65	20
Trichoderma sp	403,2	210,46	1,92
Penicillium sp	415,6	230,75	1,80
Feed (Control)	427,3	238,30	1,79

The test results ofbiological on Tabel.3 above show that the growth of chickens on a diet with the addition of fermented chicken feather meal with fungus isolates*Helicomyces sp*to produce feed consumption as much as 301.5 g / head / week, body weight gain of 150.65 g / head / week and feed conversion of 2. rations with the addition of fermented chicken feather meal using the fungusisolates *Penicillium sp*to produce feed consumption amounted to 415.6 g / head / week, weight gain of 238.30 g / head / week and ransum1.79 conversion. Ration with the addition of fermented chicken feather meal using isolates *Trichoderma sp*to produce feed consumption amounted to 403.2 g / head / week, weight gain of 210.46 g / head / week and feed conversion of 1.92.

The coefficient of digestibility of feed protein fermented with some fungus isolates

The results of feed protein digestibility coefficient fermented with some fungus isolates can be seen in Table.4 following:

Table 4. The results of feed protein digestibility coefficient fermented with some fungal isolates

Types of fungus isolates	Protein content of feed (%)	Protein content of veses (%)	The digestibility coefficients (%)
Helicomyces sp	20,18	18,63*	7,68
Trichoderma sp	20,18	16,87*	16,40
Penicillium sp	20,18	14,35*	28.89
Feed (control)	20,18	12,39*	38,60

The based of analysis on Tabel.4above, feed digestibility coefficients addition of fermented chicken feather meal with some fungus isolates, showed that the digestibility coefficients in diets with the addition of the fungus *Penicillium sp* isolates of 28.89%, the digestibility coefficients in diets with the addition of fermented chicken feather meal with fungus isolates *Helicomyces sp* at 7.68% and the coefficient of feed digestibility with the addition of chicken feather meal fermented with *Trichoderma sp* isolates amounted to 16.40%.

Result Analysis of protein content of chicken feather meal fermentation isolate fungus *Penicillium sp*

The results of the use of different doses of the fungus *Penicillium sp* isolates suspension as inoculum fermentation to increase the content of soluble protein chicken feathers meal can be seen in the following Tabel.5:

Table 5. The results of the use of different doses of the fungus *Penicillium sp* isolates suspension as inoculum fermentation

Treatments	The average (%)	Notation
		0,01
Control (R_0)	80,96	A
Inoculum fungus 1% (R_1)	88,20	B
Inoculum fungus 2% (R_2)	89,02	B
Inoculum fungus 3% (R_3)	90,90	C

Description: different notations show the influences that were significantly different ($p < 0.01$) between treatments

The based of analysis on Table .5 above, the increase in soluble protein content of fermented chicken feather meal showed that the protein content of chicken feather meal without fermentation or control (R0) influences that were significantly different ($P < 0.01$) with the content of soluble protein feather meal fungus inoculum dose of fermented chicken 1% (R1), 2% (R2) and 3% (R3). Treatment of chicken feather meal fermented with a fungal inoculum dose of 1% (R1), show the influences that were not significantly different ($P > 0.05$) with the treatment of fungus inoculum dose of 2% (R2), but to have an influence significantly different ($P < 0$ 01) the treatment of fungal inoculum dose of 3% (R3) and control (R0). The treatment of fungus inoculum dose of 3% (R3), show the influences that were significantly different ($P < 0.01$) with fungal inoculum dose of 1% (R1), 2% (R2) and control (R0).

Discussion

Isolation Soil Chicken Cage

Results of isolation soil chicken cageis done twice, the first isolation once identified under the microscope with 400x magnification obtained *Helicomyces sp* isolates fungus with mycelium traits have simple, shaped conidiophores hyaline, septate, single conidia and roll. This is in accordance with the opinion of Barnett and Hunter (1972), that *Helicomyces sp* has shaped hyaline conidiophores simple, septate, single conidia and tight roll. In addition *Helicomycessp* saprofit sp is a fungus capable of degrading keratin, according Dozie *et al*., (1994), stating that the keratin in the feathers can be degraded by fungus saprofit.

On the second insulation under the microscope with 400x magnification obtained isolate *Trichoderma sp* and *Penicellium sp*Isolates of *Trichoderma sp* rapid growth, conidia hyaline, branched, single or in groups fialides and green colored colonies. Barnett and Hunter (1972), states that *Trichoderma sp* has konidiospora hyaline, branched, fialides singly or in groups, saprofit, in the soil and the species is parasitic to other fungi. In addition *Trichoderma sp* able to produce simple sugars and are thermophilic fungi, according the opinion Zerdani *et al.*, (2004), that the keratin in the chicken feather meal can be degraded by microorganisms thermophilic microorganisms are able to grow at a temperature of 50-65 ^{0}C.

Isolates of fungus *Penicillium sp* has the ability to grow very fast, colonies bluish-green or yellow, mycelium surface has a simple, smooth, long and branched conidiophores 2-3, fialides contain chains of conidia and conidia spherical. Alexopoulus *et al.*, (1996), stating that the *Penicillium sp* has a simple misellium simple, conidia round consist of a single cell. In the end there is a set fialides conidiophores branches with chain conidia. In the opinion of Periasamy *et al.*, (2004), *Penicillium sp* is keratinofilik who have a fondness towards keratin substrates. Keratinofilik fungus can live on keratin tissue to produce keratinase enzyme substrates and utilize keratin as a source of nutrients for growth.

Quantification Spores of Fungi Isolates Soil Chicken Cage

Results of counting the number of fungus spores from the isolate largest at the soil chicken cage isolate the fungus *Penicillium sp* ie 2.65 x 106 spores / ml. This is caused by the fungus isolates have that many branches of conidiophores around 2-3 branches. At the ends of the branches are phialides contain conidia produce many spores. Conidia hyaline and mutually piled up to the top. Fungus colonies growing spread rapidly. Cappuccino and Sherman (1987), stating that the *Penicillium sp* growing spread rapidly, branched conidiophores around 2-3 branches, at the ends of branches are phialides contain conidia (spores single) and generate a lot of spores. While fungus isolates *Helicomyces sp* has shaped hyaline conidiophores simple, single conidia and relatively slow growth of fungus colonies to produce the amount of spores slightly.

Microbes (fungus) derived from a single cell spores that grow and develop into an individual fungus and to produce an enzyme that plays a role in reshuffle the complex organic compounds in the fermentation process. The more a microbe that helps the fermentation process means more components of a complex organic compound which is capable overhauled by the microbe. Fungus *Penicillium sp* produce cell spores that very much and intensity of growth is very high, it means more mushrooms produced, will be many components of keratin (bond peptide complex) from chicken feathers meal capable judged to be binding peptide simple (protein) with the help of enzymes keratinase which produced by the fungal isolates, corresponding according to Tjitjah (1997), that the fermentation is a process of reform of the complex organic compounds into simpler ones with the help of an enzyme produced from a microbe.

The results of the analysis of dry weight loss percentage fermented chicken feathers meal

Dry weight loss percentage is highest in fermented chicken feathers to isolate the fungus *Penicillium sp* amounted to 31.84%, corresponding according to Hadi and Muhsin (2002), that the use of the fungus *Aspergillus sp* isolates ferment chicken feather meal experience dry weight percentage loss by 32%,Treatment with fungal isolates *Penicillum sp* has lost the highest percentage of dry weight because these mushrooms have a high intensity of growth, and thus more able to carry out the reform process dry ingredients into a source of nutrients for growth. Dry matter overhauled by the fungus becomes a source of nutrients for growth during the fermentation process. Appropriate according Edhy and Siregar (2004), if the fungus has the intensity of high growth, the percentage dry weight loss after fermentation chicken feather meal increases.

On treatment with fungal isolates *Helicomyces sp* experiencing weight loss are low because of the low intensity of the growth of fungi that have low ability also remodel the dry material as a nutrient source for mold growth. Appropriate according to Hadi and Muhsin (2002), stating that the degradation of keratin in the fermentation process is characterized by an increase in dry weight percentage loss of chicken feather meal fermentation. The higher the percentage dry weight loss, meaning isolate the fungus is able to degrade keratin in chicken feather meal.

The result of biological assay using chicken feather meal fermented with some fungus isolates on the growth of chicken

Fermentation chicken feather meal with isolates of the fungus *Penicillium sp* produce chicken growth higher than the use of other fungal isolates. This happens because the diet with the addition of fermentation chicken feather meal with isolates of the fungus *Penicillium sp* more can be absorbed by the chicken's body to produce growth correspond according to Periasamy *et al.*, (2004), that isolate this fungus is a fungus keratinofilik capable of degrading keratin in feather meal chicken.

A feed of efficient and high in nutrients good if it produces a low feed conversion. This means that the nutrient content of the feed could be absorbed by the body which is expressed by an increase in weight gain. Appropriate in the opinion of Gaman and Sherrington (1992), stating that the more a bond of cystine disulfide (binding peptide complex) of keratin which can be binding peptide simple (protein) during the fermentation process, the more the protein that can be absorbed by the body and generate growth.

The use of the fungus *Penicillium sp* isolates fermentation chicken feather meal did not affect the health of chickens due to isolate the fungus produces a substance penicillin antibiotic, wherein the antibiotic used as a supplement to improve the nutritional value of feed rations and help the digestive process in the body. Appropriate according to Darkuni (2001), that the fungus *Penicillium sp* produce antibiotic substances

The coefficient of digestibility of feed protein fermented with some fungus isolates

This happens because the fungus isolates *Penicillium sp* produce keratinase enzyme capable of degrading keratin (bond peptide complex) chicken feather meal, be a simple peptide bond (protein) that is readily absorbed by the body. Fungus isolates *Helicomyces sp*a dermatophyte fungus which can degrade the keratin in the skin tissue, according Dwidjosaputro opinion (1984), stating *Helicomyces sp* cause various skin diseases (dermatophytes) and capable of degrading keratin.

Digestibility coefficient is influenced by the content of protein and crude fiber feed, which protein chicken feather meal consists of protein fibers (fibrous), so the more the protein content of chicken feather meal that can be absorbed by the body, meaning that the ration digestibility coefficient will increase. In accordance opinions Widodo (2002), that the coefficient of digestibility or digestibility of a feed level is influenced by the balance between protein content of nutrients and fiber. The more undigested protein in the ration that can be absorbed by the body then the coefficient of digestibility of the ration also increased.

The result Analysis of Protein Content of Chicken Feather Meal Fermentation fungus isolate *Penicillium sp*

In the treatment of fermentation dose of inoculumfungus isolate *Penicillium sp*3% (R3) an increase in the content of soluble protein were higher than other doses because at that dose there is a balance between the availability of nutrients in the fermentation medium with the number of microbes that are available, so the increase in mass quantities of microbial cells will cause an increase chicken feather meal protein content after fermentation. Appropriate according to Tjitjah (1997), states that in the fermentation process utilizing fungus isolate *Penicillium sp* substrate as a nutrient source for growth. Increasing the number of microbial cells identical with increased content of soluble protein which is a reflection of the number of cell mass, as more and more microbes that overhauling components chicken feather keratin protein powder dissolved after fermentation will also increase.

On the use of fungal inoculum dose lower than 3% decline in the dissolved protein content of chicken feather meal, because the amount of fungal inoculum available at the beginning of the fermentation is also relatively small so that at the end of fermentation to produce low protein. Appropriate according to Nurhayati *et al.*, (2000), suggesting differences in the number of microbes on the initial fermentation resulting in a doubling of the number of different cells and affect the increased protein content.

Conclusions

The results showed that isolate fungus soil chicken cage better able to increase the protein content of chicken feather meal after fermentation is a fungus isolate inoculum *Penicillium sp* with as much as 3%. The

results of the analysis of the chicken feather meal protein content highs after fermented to isolate the fungus *Penicillium sp* amounted to 90.90 %%. The addition of chicken feather meal fermented with the fungus *Penicillium sp* isolates produce the best growth of broiler chickens that feed consumption amounted to 415.6 g / head / week, weight gain of 230, 75 g / head / week and feed conversion of 1.8 and feed coefficients digestibility by 28, 89%.

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