

# THE GROWTH OF BODY LENGTH AND WEIGHT OF MALE WISTARS SUPPLIED WITH ANCHOVIES (*Stolephorus sp.*) AS ADDITIONAL DIET

## PERTUMBUHAN PANJANG DAN BERAT BADAN TIKUS WISTAR JANTAN YANG DIBERI DIET TAMBAHAN IKAN TERI (*Stolephorus sp.*)

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### Abstract

**Background:** Growth is affected by nutrition contents in the diet consumed. Nutrition playing role in the growth process is carbohydrate, protein, fat, mineral, water, and vitamins. Calcium is one of important minerals involving in cell metabolism process needed in the process of growth and development. One of sources of animal calcium is anchovy, besides its cheap price, anchovies may be consumed wholly together with their bones. The purpose of this study was to observe whether the supply of anchovies as additional diet may increase the growth of male wistars. **Methods:** A number of 12 male wistars divided into two groups, control and experimental groups. The control group was only supplied with standard diet and sterile aquades, while the other group was supplied with anchovies as additional diet through oral sondage of 0,00062 gr/day x BW (Body Weight) for 40 days. Every wistar in each group was subsequently measured for its body length and weight once a week to observe its growth and development. The data obtained were analyzed using anova test and LSD orderly. **Results:** The result demonstrated the increase in the body length and weight of the male wistars of both groups in each week. Anova statistical test that was continued with LSD test showed that there was significant increase ( $p < 0,05$ ) in the experimental group in each week compared to the control group. **Conclusion:** The supply of anchovies (*Stolephorus sp.*) as additional diet may increase the growth of male wistars body length and weight.

**Key word :** anchovies (*Stolephorus sp.*), growth and development, protein

### Abstract

**Background** Pertumbuhan dipengaruhi oleh zat gizi yang terkandung dalam makanan. Zat gizi yang berperan pada proses pertumbuhan adalah karbohidrat, protein, lemak, mineral, air dan vitamin. Kalsium adalah salah mineral penting yang terlibat dalam proses metabolisme sel yang diperlukan dalam proses pertumbuhan dan perkembangan. Salah satu sumber alternatif kalsium hewani adalah ikan teri, karena disamping murah harganya ikan teri dapat dimakan bersama tulangnya. Tujuan penelitian ini adalah untuk mengetahui apakah pemberian diet tambahan ikan teri dapat meningkatkan pertumbuhan tikus wistar jantan. **Metode** digunakan 12 ekor tikus wistar jantan, yang dibagi dua kelompok yaitu kelompok kontrol dan kelompok perlakuan. Kelompok kontrol hanya diberi pakan standart tikus dan aquades steril, sedangkan kelompok perlakuan ditambahkan konsumsi ikan teri dengan sondase oral sebanyak 0,0062gr/hari x BB tikus selama 40 hari. Setiap ekor tikus pada masing-masing kelompok dihitung panjang dan berat badannya setiap satu minggu sekali untuk mengetahui pertumbuhan dan perkembangannya. Selanjutnya dilakukan

analisa data dengan uji anova dan dilanjutkan dengan uji LSD. **Hasil penelitian**, Hasil penelitian menunjukkan adanya peningkatan panjang dan berat badan tikus wistar jantan semua kelompok pada setiap minggunya. Hasil uji statistik anova dan dilanjutkan dengan uji LSD, menunjukkan terdapat peningkatan yang signifikan ( $p < 0,05$ ) pada kelompok perlakuan dalam setiap minggu dibandingkan dengan kelompok kontrol. **Conclusion**, pemberian diet tambahan ikan teri dapat meningkatkan pertumbuhan panjang dan berat badan tikus wistar jantan.

**Key word** : ikan teri, pertumbuhan dan perkembangan, protein, kalsium

## Intoduction

Growth is the change of body related to development of body size both physically and structurally<sup>1</sup>. The process of growht includes cellular multiplication and the accumulation of intracellular substance number in the physical aspects, in mature ages, cellular multiplication and formation only function to renew the damage cells<sup>2</sup>. One of the growth paramenters is body weighth and heighth or body length<sup>1</sup>. In general, the growth is affected by two factors i.e internal and external factors. An internal factor playing role in body growth is nutrition or essential nutritious substance in the food consumption. Besides functioning as cellular tissue formation, it also roles to subtitute cells and to maintain damage organ functions. Carbohydrate, protein, mineral, water, vitamin are important nutritious substances, however, protein is considered as the most important in the growth process, it functions to increase protein synthesis and cell division<sup>3,4</sup>. Animal protein is an essential substance in the growth process, and is better than plant protein due to possessing more amino acid content. One of the animal protein sources is anchovy (*stolephorus sp.*) that is rich of protein and mineral calcium and phospor. Moreover, anchovy (*stolephorus sp.*) may be consumed wholly from head, meat and the bones<sup>5</sup>.

The purpose of this study was to observe whether the supply of anchovies as additional diet may increase the growth of male wistars.

## Materials And Methods

The study was laboratory experimental *in vivo* using pre and post test control group design. It was conducted at Physiological Laboratory Biomedical Department Faculty of Dentistry Jember University. The samples were 12 male wistar rats devided into two groups, control and experimental. The control group was merely supplied with standard diet and sterile aquades, while the experimental group was supplied with anchovies as additional diet through oral sondase of 0,00062 gr/day x BW (Body Weighth) for 40 days<sup>6</sup>. Prior to the experiment, each rat was measured for its weighth and length. Subsequently, the rats in each group were measured for its body weighth and length once a week for five weeks. The measurement of rats' body weighth was conducted by gram unit scaling, and their length was measured for total body length started from nose up to tail using measure tape with centimeter unit<sup>7</sup>.

Anchovy supply was prepared from 100gr fresh dried anchovies that were subsequently blended and suplied to the rats through oral sondage according to the dose determined for 5 weeks. The measurement of growth acceleration of the rats' weighth and length was obtained by counting the deviation of the rats' weight and length in each week. The data obtained were tested using Kolmogorov-Smirnov test, Levene test, One Way Anova test and LSD test with reliability of 95%.

## Results

Table 1. The average value of the rats' body weight (gram) pre and post experiment.

Group	Pre-experiment	Post-experiment				
		Week I	Week II	Week III	Week IV	Week V
C	151,83	152,95	154,49	156,36	158,42	160,6
E	146,17	148,3	151,06	154,16	158,41	163,16

Table 2. The average of deviation of the growth acceleration of the rats' body weight (gram) of each group in every week

Group	Week I	Week II	Week III	Week IV	Week V
C	1,12	1,54	1,87	2,06	2,18
E	2,13	2,76	3,1	4,25	4,75

Table 3. The average value of the rats' body length (cm) pre and post experiment.

Group	Pre-experiment	Post-experiment				
		Week I	Week I	Week I	Week I	Week I
C	27,91	28,32	28,97	29,66	30,4	31,28
E	28,72	30,28	32,07	33,98	36,01	38,43

Table 4. The average value of deviation of the growth acceleration of the rats' body length (cm) of each group in every week.

Group	Week I	Week II	Week III	Week IV	Week V
C	0,4	0,65	0,69	0,74	0,88
E	1,56	1,719	1,91	2,03	2,42

Note

C : Control

E : Experimental

### Analysis Of Data

#### I. Body Weight Increase

The data obtained were tested for their homogeneity and normality, and they were normally-and-homogenly distributed  $P > 0,05$ . One Way Anova test was conducted to observe whether or not there were differences in the rats' body weight increase in each week,

the result showed that there was a difference of  $P < 0,05$ . LSD test was then conducted to observe the week demonstrating significant increase of the rats' body weight. The result showed that there was significant increase in the rats' body weight in each week in the experimental group compared to the control group  $P < 0,05$ .

Table 5. The result of LSD Test on the Increase of the Rats' Body Weight in Each Week between Control Group and Experimental Group ( $\alpha = 0,05$ ).

	Week I				
Week I	-	0,00*	0,04*	0,01*	0,00*
Week I	0,00*	-	0,01*	0,01*	0,01*
Week I	0,04*	0,01*	-	0,01*	0,00*
Week I	0,01*	0,01*	0,01*	-	0,00*
Week I	0,00*	0,01*	0,00*	0,00*	-

Note: \* there was a significant difference ( $P < 0,05$ )

## II. Body Length Increase

The data obtained were tested for their homogeneity and normality, and they were normally-and-homogenly distributed  $P > 0,05$ . One Way Anova test was conducted to observe whether or not there were differences in the rats' body length addition in each week,

the result showed that there was a difference of  $P < 0,05$ . LSD test was then conducted to observe the week demonstrating significant increase of the rats' body length. The result showed that there was significant increase in the rats' body length in each week in the experimental group compared to the control group  $P < 0,05$ .

Table 6. The result of LSD Test on the Increase of the Rats' Body Length in Each Week between Control Group and Experimental Group ( $\alpha = 0,05$ ).

	Week I				
Week I	-	0,00*	0,04*	0,01*	0,00*
Week I	0,00*	-	0,01*	0,01*	0,01*
Week I	0,04*	0,01*	-	0,01*	0,00*
Week I	0,01*	0,01*	0,01*	-	0,00*
Week I	0,00*	0,01*	0,00*	0,00*	-

Note: \* there was a significant difference ( $P < 0,05$ )

## Discussion

Based on the analysis of the data, it was obtained the growth of body weight and length in each week both in the control group and experimental group, however, the experimental group showed that the acceleration growth of the rats' body weight and length was higher compared to the control group, it was considered as the result of supplying anchovies as additional diet.

Anchovies possess high protein content. The basic element forming protein is amino acid. Anchovies (*Stolephorus sp.*)

contain a lot of essential amino acid and non essential amino acid. The most essential amino acids are isoleucine, leucine, lysine and valine. Non essential amino acid contained in anchovies is glutamic acid, aspartic acid and glycine<sup>8</sup>.

Protein in the anchovies supplied to the rats of the experimental group is long chains of amino acids tied together with peptide bond. Protein will be digested within the gastric, and by gastric pepsin enzyme, it is altered into peptone, proteose, polypeptide. It is subsequently digested again by trypsin,

chymotrypsin in the upper small intestine that is secreted by pancreas into small polypeptides. In the intestinal lumen, it is reached by enterocyte layering small intestinal villi. Cells possess brush border containing hundreds of microvillii. In every microvilli, there is peptidase enzyme. This enzyme will change the small polypeptides into dipeptide, tripeptide, and be brought into cytosol enterocyte, digested for several minutes up to the last step into single amino acids. It is subsequently carried to the other side of enterocyte entering the blood, and through active transport using carrier mechanism, single amino acid enters into the bones. The single amino acid joins each other to form cellular protein i.e collagen protein<sup>9</sup>.

One of cellular proteins is collagen protein. Collagen formation in bones is conducted by osteoblast cells. The mechanism of collagen formation by osteoblast cells is considered the same as collagen formation by fibroblast cell. Collagen synthesis orderly includes combination of amino acid into chain shape joining to form molecules and subsequently combines to form fibrils united in bundle. The first synthesis occurs in the intracellulars, to produce procollagen molecules, in the active condition, resides in the extracellular area. Synthesis in the intracellulars produces three identical chains  $\alpha$  as collagen type III and three different chains as type I. Furthermore, procollagen leaves cells, and some amino acids are incised enzymatically to form tropocollagen called collagen molecule. Collagen molecules are polymerized rapidly to form collagen fiber, and the tissue formed is called osteoid. Later, it roles in the process of bone formation<sup>9</sup>.

Besides protein, anchovies also contain of high calcium. It possesses essential role in the body i.e bone formation. Calcium in bones possesses two functions : a) as the integral part of bone structure, (b) as calcium storage. The process of bone formation is initiated in early growth of fetus, by forming strong matrix, however it is still soft and elastic, that becomes the origin of bones. Matrix, being

one third part of bones, comprises of fiber composed from collagen covered with gelatin material<sup>12</sup>.

As soon as matrix is formed and becomes strong and hardened through calcification process, that is the forming of mineral crystals containing calcium compound. This crystal comprises of phosphate calcium or combination between phosphate calcium and hydroxide called hydroxyapatite  $\{3Ca_3(PO_4)_2 \cdot Ca(OH)_2\}$ . Since calcium is the main mineral in this bond, both must be available in adequate amount in the fluid surrounding the bone matrix.

Bone diaphysis as the hard part of matrix contains calcium, phosphate, magnesium, zinc, sodium bicarbonate, and fluor, besides hydroxyapatite<sup>12</sup>. Throughout life, bones always changes both in their form and density in conjunction with age and body weight. The factors affecting calcification/boning are genetic (to determine bone mass); sexual hormone and physical activities (to influence bone metabolism); and body weight is inversely proportional to bone fracture risk<sup>13,14</sup>.

Calcium is really needed in growth due to its importance in bone formation, also needed in the less amount to support cellular functions in body. A study in Japan suggests that people with low calcium diet are shorter than those with adequate calcium die in the time of bone growth<sup>14</sup>. High calcium and protein contents in anchovy (*Stlephorus sp.*) have been considered capable to fulfill nutrition and mineral needs for bones. Calcium seemingly may fulfill bone needs in the process of bone formation. Whereas, protein is considered capable to complete bone collagen formation. Thus, they may increase the rats' body weight and length.

## Conclusion

The supply of achovy (*Stolephorus sp.*) as additional diet may increase the growth of body weight and length of male wistar rats.

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