# ACTIVITY OF MACKEREL SCAD *(Decapterus macrosoma)* FLESH BROTH AND POWDERED BONES ON HYPOTHYROIDIC MALE WISTAR RATS *(Rattus norvegicus)*

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## ABSTRACT

This study was conducted to examine and assess the activity of Mackerel scad (Decapterus macrosoma) Flesh broth and powdered bones. Methods include induction of Hypothyroidism among Male Wistar Rats (Rattus norvegicus) using methimazole. Pre- and post-induction determination of thyroid hormones was conducted. The test subjects were divided into five groups. Group A was treated with 3 mL of Fish Flesh Broth and 350 mg of Powdered Fish bones. Group B was treated with 2.25 mL of Fish Flesh Broth and 700 mg of Powdered Fish Bones. Group C was given 1.5 mL of Fish Flesh Broth and 1050 mg of Powdered Fish Bones. Group D received 150 mcg of Levothyroxine. Group E received normal feeding and Distilled water. The treatment from each group was administered orally for 10 days. After induction of Hypothyroidism, each rat from each group was subjected for Thyroid Hormones (T3, T4 and TSH) determination. For statistical analysis, values expressed are mean ± SEM (Standard error of mean). The result of the mean difference is significant at 0.05 level. It is based on Analysis of Variance (ANOVA). It is shown that Mackerel scad Fish Flesh Broth and Powdered bones are not significant for TSH. However, Mackerel scad Flesh Broth and Powdered Bones are effective in normalizing thyroid hormones due to the increase level of T3 and T4 before and after the treatment. The value of the result was accurate to the normal value which is the negative control. Therefore, Flesh broth and Powdered bones of Mackerel scad is significant in increasing the levels of T3 and T4.

**Keywords:** *Decapterus macrosoma, Rattus norvegicus, methimazole, thyroid hormones, hypothyroidism*

## INTRODUCTION

The thyroid gland has the main role of controlling our metabolism which is through the conversion of food to energy. Our body weight is mostly affected by the function of thyroid gland which is why people with dysfunctional thyroid gland have sudden changes in their weight. The thyroid gland also controls the homeostasis that regulates the rate of each function in the body by absorbing iodine, which can be found on many food and convert it into its two hormones; thyroxine (T4) and triiodothyronine (T3) which are continuously released for the growth, and maturation of the body.

Iodine deficiency occurs when iodine intake falls below recommended levels and the thyroid gland is no longer able to synthesize sufficient amounts of thyroid hormone (World Health Organization (WHO), 2008). When thyroid hormone synthesis is impaired, it results to hypothyroidism. Hypothyroidism is a thyroid disorder of low free thyroxine (T4) level. According to the Journal of the ASEAN Federation of Endocrine Societies (2012), the prevalence of thyroid function abnormalities in the Philippines is 8.53%. Hypothyroidism can be difficult to diagnose because it is asymptomatic. The Southeast Asian region, that includes the Philippines, had the most number of school aged children with deficient iodine intake (Andersson et al. 2012). The severity of the symptoms depends on the severity of the disease and how long the disease has been progressing and the symptoms may be so mild at first that they are nearly undetectable (Plotnick, 2016).

Medications and therapy of hypothyroidism has been known to give adverse effects if not taken properly. Long-term usage of levothyroxine, a known oral medication for hypothyroidism, in women has shown to increase the risk of osteoporosis, the decrease in density of the bones and this may leave the patient more susceptible to fracture (Noble, 2016). Hypothyroidism can be treated with the help of natural and nutritional foods rich in iodine to prevent the risk from the medication of hypothyroidism. Mackerel scad (*Decapterus macrosoma*) or most commonly known as Galunggong in the Philippines, is a saltwater fish species in the family Carangidae of order Perciformes that is a sustainable seafood source. It is generally farmed by commercial fisheries and usually used as baits by fishermen (Ramos and Bago, 2013). Mackerel scad is filled with iodine which is essential for a healthy thyroid gland and regulating metabolic rate. Thus, this study shows the activity of Mackerel scad (*Decapterus macrosoma)* flesh and bones against hypothyroidism on male Wistar rats.

**Research Questions**

This study was conducted to evaluate and monitor the activity of Mackerel scad (*Decapterus macrosoma)* flesh broth and powdered bones as a treatment for hypothyroidism on hypothyroidic male Wistar rats (*Rattus norvegicus*). Specifically, to answer the following:

1. Is there a significant difference between the level of thyroid hormones T3, T4, and TSH before and after the administration of the following to the hypothyroidic Albino rats?
    a) Treatment A (3mL Fish Flesh Broth and 350mg Powdered Fish Bones)
    b) Treatment B (2.25mL Fish Flesh Broth and 700mg Powdered Fish Bones
    c) Treatment C (1.5mL Fish Flesh Broth and 1050mg Powdered Fish Bones)
    d) Treatment D (Levothyroxine)

e) Negative Control

2. Is there a significant difference between the following treatment dose of Mackerel scad flesh broth and powdered bones to the Positive and Negative control before and after its administration?
    a) Treatment A (3 mL Fish Flesh Broth and 1mg Powdered Fish Bones)
    b) Treatment B (2.25mL Fish Flesh Broth and 2mg Powdered Fish Bones
    c) Treatment C (1.5mL Fish Flesh Broth and 3mg Powdered Fish Bones)
3. Is there a significant difference between the level of thyroid hormones T3, T4, and TSH of Treatment A with that of the Treatment D (Levothyroxine) and Negative Control?
4. Is there a significant difference between the level of thyroid hormones T3, T4, and TSH of Treatment B with that of the Treatment D (Levothyroxine) and Negative Control?
5. Is there a significant difference between the level of thyroid hormones T3, T4, and TSH of Treatment C with that of the Treatment D (Levothyroxine) and Negative Control?

**Hypotheses**

1. There is no significant difference between the level of thyroid hormones before and after the administration of the following to the hypothyroidic Albino rats:
    a. Treatment A (3mL Fish Flesh Broth and 1mg Powdered Fish Bones)
    b. reatment B (2.25mL Fish Flesh Broth and 2mg Powdered Fish Bones)
    c. Treatment C (1.5mL Fish Flesh Broth and 3mg Powdered Fish Bones)
    d. Treatment D (Levothyroxine)
    e. Negative Control
2. There is no significant difference between the following treatment dose of Mackerel scad flesh broth and powdered bones to the Positive and Negative control before and after its administration?
    a. Treatment A (3mL Fish Flesh Broth and 1mg Powdered Fish Bones)
    b. Treatment B (2.25mL Fish Flesh Broth and 2mg Powdered Fish Bones)
    c. Treatment C (1.5mL Fish Flesh Broth and 3mg Powdered Fish Bones)
3. There is no significant difference between the level of thyroid hormones T3, T4, and TSH of Treatment A with that of the Treatment D (Levothyroxine) and Negative Control.
4. There is no significant difference between the level of thyroid hormones T3, T4, and TSH of Treatment B with that of the Treatment D (Levothyroxine) and Negative Control.
5. There is no significant difference between the level of thyroid hormones T3, T4, and TSH of Treatment C with that of the Treatment D (Levothyroxine) and Negative Control

## Significance of the Study

The findings of this study will be beneficial to the health care in providing nutritional, natural, and affordable treatment through the discovery of natural resources for medication of hypothyroidism. The researchers' goal is designed to help the health workers to promote innovative advancement in the medical field of research, to gain knowledge and experience from this study, and to contribute the findings of this study for the future researchers who will have a related topic with ours. This research will also provide safe and accessible source of treatment for people especially to those who can't afford and avail medical services.

## Literature Review

### Mackerel scad (*Decapterus macrosoma*)

Galunggong or Mackerel Scad (Decapterus macrosoma) inhabit the coastal waters of the Philippine archipelago in droves, traveling in edlarge schools and getting caught in fishermen's nets nearly every minute of every day (Market Manila, 2016).

Iodine is an essential trace element of great importance in human nutrition. The element is an integral part of the thyroid hormones and iodine deficiency leads to endemic goiter (enlarged thyroid) and other iodine deficiency disorders. The main iodine supply occurs via nutrition and marine seafood is the only natural source containing relatively large amounts of iodine (Azmat, Talat and Mahmood, 2018).. However, the iodine content of marine fish depends on the species and can vary considerably (Azmat and Talat, 2008). The highest mean iodine content of processed fish was determined to be 2.149mg in smoked Mackerel scad (Erkan, 2011). Cold water fish such as Mackerel scad, salmon, and sardines should be consumed at least several times per week (Debe, 2013).

### Thyroid Gland, Hypothyroidism, and its Treatment

Thyroid hormone (TH) is required for normal development as well as regulating metabolism in the adult. Thyroid hormone (TH) regulates metabolic processes essential for normal growth and development as well as regulating metabolism in the adult. It is well established that thyroid hormone status correlates with body weight and energy expenditure (Mullur, Yun Liu, and Brent, 2013). Thyroxine (T4) and Triiodothyronine (T3) are produced from the thyroid gland. T4 is produced only from the thyroid, whereas T3 from the thyroid and from T4 deiodination in extrathyroidal tissues. T3 deficiency is responsible for the clinical and biochemical manifestations of hypothyroidism (Athanassiou and Ntalles, 2010).

Hypothyroidism, reduced thyroid hormone levels, is associated with hypometabolism characterized by reduced resting energy expenditure, weight gain, increased cholesterol levels, reduced lipolysis, and reduced gluconeogenesis (Mullur, Yun Liu, and Brent, 2013). Thyroid hormones are involved in metabolic regulation and affect body weight and body mass index (BMI). One might therefore expect to see equivalent weight gain in hypothyroidism as a result of a decreased metabolic rate (Perveen, Amjad, and Bashir, 2012).

The thyroid gland activity is regulated by hypothalamic- pituitary-thyroid axis, including negative feedback loop. Insufficiency of the thyroid hormones in circulation stimulates pituitary to secrete thyroid-stimulating hormone (TSH), which has a critical role in the thyroid growth and activity. Under TSH stimulation, the thyroid gland undergoes enlargement, hyperplasia, neovascularisation and morphological alterations of the thyrocytes related to their engagement in production, processing and releasing of thyroid hormones (Milosevic, Korac, and Davidovic, 2016).

Levothyroxine is the treatment of choice for hypothyroidism. It has a 7 day half-life, allowing daily dosing. Several medications, supplements, and food can interfere with the absorption and action of levothyroxine. Common drugs that can affect levothyroxine absorption include iron, calcium, cholestyramine, and aluminum and levothyroxine must be taken at least 4 hours apart from these drugs. Enzyme inducers, such as phenytoin, carbamazepine, phenobarbital, and rifampicin can increase the clearance of levothyroxine, necessitating an increased dose. (Chakera, Pearce, and Vaidya, 2012).

**Traditional and Alternative Medicine Act of 1997**

Republic Act 8423 (RA 8423) also known as the Traditional and Alternative Medicine Act of 1997, focuses on developing different traditional health-related management in the country.Drugs for prevention, cure, lessening signs and symptoms, diagnosis and maintaining a healthy lifestyle with lower price are needed to be explored and developed. The alternative medications undergo methods of proper compounding (Jose N. Nolledo, 2015).

Philippines seeks to address the intertwining issues of health care accessibility, affordability, and efficacy, particularly with respect to the poor and disadvantaged, through traditional, complementary, and alternative medicine (Mendoza, 2009).

**Research Simulacrum**

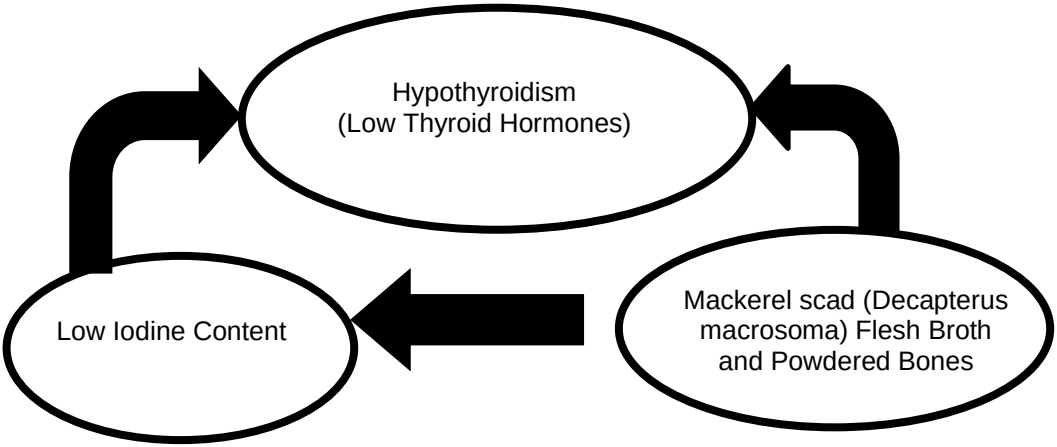


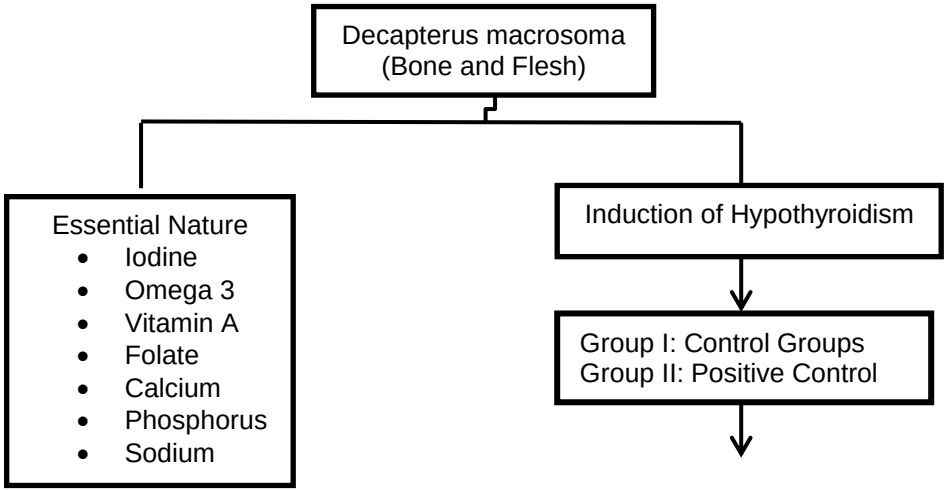

**Figure 1.** *Research Simulacrum*

Figure 1 shows the whole concept of the study. Iodine deficiency will lead to hypothyroidism. Defect in the thyroid gland can affect the overall metabolism of the body. The researchers studied the activity of Mackerel scad (*Decapterus macrosoma*) flesh broth and powdered bones as an alternative treatment of hypothyroidism.

## METHODS

### Research Design

The researchers used experimental design in conducting this research entitled Activity of Mackerel scad (*Decapterus macrosoma*) flesh broth and powdered bones on hypothyroidic male Wistar rats (*Rattus norvegicus*).



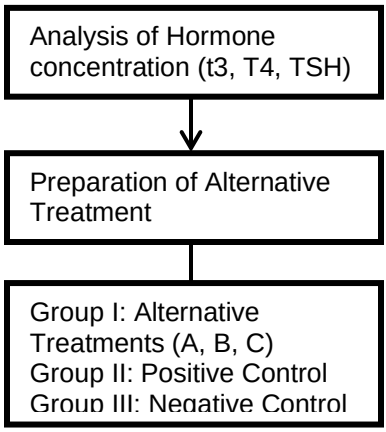



**Figure 2.** *Methodological Flowchart*

**Locale of the Study**

Mackerel scads were gathered in Don Domingo Public Market Tuguegarao City, Cagayan. The preparation of fish flesh broth and powdered bones were conducted in Medical Technology Laboratory of University of Saint Louis, Tuguegarao. All procedures involving experimental animals were done in Carig Tuguegarao City, Cagayan under the supervision of a Veterinarian.

**Samples and Subject of the Study**

**Fish Sample**

Mackerel scad measuring 20-25 cm both male and female were gathered in Cagayan. The fish were washed using tap water. The flesh of the Mackerel scad were boiled and the bones were powdered using mortar and pestle. With designated measurement according to the treatment, flesh broth and powdered bones were combined as a mixture.

**Animal Subject**

Two to three-month-old male Wistar rats weighing 80-100 grams were divided into negative control and experimental group wherein negative control received normal rat food while experimental group were conditioned to hypothyroidism and used as experimental animals.

**Data Collection, Instruments and Procedures**

Preparation of Test Animals

The experimental animals were habituated for two (2) weeks with the assistance of a Veterinarian. Factors such as room temperature, good humidity level, free from pathogenic microorganisms, and free access to water were observed to ensure that their condition will not be affected by the lack of these factors. Throughout the study, food intake and body weight of the rats were monitored daily, and body composition was assessed.

The rats (Experimental group) were made hypothyroid by giving 0.025% (w/v%) methimazole (MMI) in their drinking water for 22 days.

Evaluation of the Post Induction levels of Thyroid hormones

On day 21, Methimazole induced treated rats received a saline injection. Blood from each animal was collected from rat tail vein transferred to centrifuge tubes with no anticoagulant, and serum was separated by low-speed centrifugation (1500 xg 51 min). The serum samples were stored at -20°C until the analysis time. Serum thyroid hormones [total T3, total T4 and thyroid stimulating hormone (TSH)] levels were measured by in vitro diagnostic radioimmunoassay with the immunolite 2000 analyzer for the quantitative measurement (Herwig, Campbell, Mayer, Boelen, Anderson, Ross, and Barrett, 2014).

**Table 1.** *Post Induction levels of Thyroid hormones from Hypothyroidic Albino Rats*

| SUBJECTS | T3 nmol/L | T4 ng/mL | TSH nmol/L |
|---|---|---|---|
| A1 | 0.64 | 27.70 | 0.01 |
| A2 | 0.59 | 26.59 | 0.01 |
| A3 | 0.69 | 18.22 | 0.01 |
| A4 | 0.55 | 25.61 | 0.01 |
| B1 | 0.64 | 17.68 | 0.01 |
| B2 | 0.71 | 21.36 | 0.01 |
| B3 | 0.59 | 23.02 | 0.01 |
| B4 | 0.67 | 19.89 | 0.01 |
| C1 | 0.72 | 19.24 | 0.01 |
| C2 | 0.62 | 10.67 | 0.01 |
| C3 | 0.73 | 26.50 | 0.01 |
| C4 | 0.58 | 22.01 | 0.01 |
| D1 | 0.55 | 20.40 | 0.01 |

| | | | |
|---|---|---|---|
| D2 | 0.59 | 19.95 | 0.01 |
| D3 | 0.70 | 15.79 | 0.01 |
| D4 | 0.68 | 23.56 | 0.01 |
| E1 | 1.13 | 32.95 | 0.01 |
| E2 | 1.32 | 37.02 | 0.01 |
| E3 | 0.89 | 29.61 | 0.01 |
| E4 | 0.91 | 29.05 | 0.01 |

Evaluation of the level of thyroid hormone during and after induction

After induction of Hypothyroidism using Methimazole, all animals (Experimental Group and Control Group) were subjected in monitoring of the level of T3, T4, and TSH.

**Table 2.** *Levels of Thyroid hormones from Hypothyroidic Albino Rats after administration of the Treatments.*

| SUBJECTS | T3 nmol/L | T4 ng/mL | TSH nmol/L |
|---|---|---|---|
| A1 | 0.75 | 28.33 | 0.01 |
| A2 | 0.86 | 32.41 | 0.01 |
| A3 | 0.81 | 25.74 | 0.01 |
| A4 | 0.58 | 29.06 | 0.01 |
| B1 | 0.71 | 20.54 | 0.01 |
| B2 | 0.87 | 30.96 | 0.01 |
| B3 | 0.64 | 31.54 | 0.01 |
| B4 | 0.83 | 28.76 | 0.01 |
| C1 | 1.09 | 29.06 | 0.01 |
| C2 | 0.78 | 21.55 | 0.01 |
| C3 | 1.15 | 33.70 | 0.01 |
| C4 | 0.61 | 28.43 | 0.01 |
| D1 | 4.60 | 98.94 | 0.01 |
| D2 | 1.47 | 115.54 | 0.01 |
| D3 | 1.24 | 82.76 | 0.01 |
| D4 | 2.43 | 74.17 | 0.01 |
| E1 | 1.12 | 32.85 | 0.01 |

| | | | |
|---|---|---|---|
| E2 | 1.30 | 37.07 | 0.01 |
| E3 | 0.91 | 29.59 | 0.01 |
| E4 | 1.02 | 29.14 | 0.01 |

## 1. Preparation of the Treatment Solution

### 1.1. Preparation of Powdered Fish Bones as the Solute

The fishes weighing 1 kg were deboned by the researchers. The bones were dried using an oven for 30 minutes at 73.4 º F (23ºC). The dried bones were powdered using mortar and pestle. The powdered fish bones acted as the solute of the solution. This procedure was done every two day interval within ten days.

### 1.2. Preparation Fish Flesh Broth as the Solvent

The remaining flesh from the earlier procedure was directly boiled in 1000 mL distilled water for 30-45 minutes. The broth acted as the solvent. This procedure was done every two day interval within ten days.

## 2. Treatment for Hypothyroidism

**Group I:** Negative Control received regular rat food such as cabbage.

**Group II:** Experimental Group

A. Treatment using Mackerel scad flesh broth and powdered bones.

B. Treatment using standard drug, Levothyroxine (10 micrograms/kg).

### 2.1. Infusion of Fish flesh broth with powdered bones for treating induced Hypothyroidism in rats

3 ml is the recommended volume for the administration of a solution through intragastric for rats weighing 100 grams (Nebendahl, 2015). Infusion of the solution was through gavage. 1-3mL treatment solution was administered to twelve (12) experimental rats (A) with corresponding volume of solvent and grams of solute based from the treatments. Administration of the solution was given once a day for 10 days.

### 2.2. Infusion of Levothyroxine

For comparison with the activity of Mackerel scad fish flesh broth and powdered bones, oral administration of 10 micrograms/kg (equal to: 0.01mg/kg)

Levothyroxine was administered daily to four (4) experimental rats (B) for 22 days (Grant, 2016).

### 2.3. Evaluation of the level of thyroid hormone after infusion of fish flesh broth with powdered bones

On day 10, same procedure as the evaluation of post induction levels of thyroid hormones was conducted except for the saline injection.

### 2.4. Evaluation of the level of thyroid hormone after infusion of levothyroxine

On day 22, same procedure as the evaluation of post induction levels of thyroid hormones was conducted except for the saline injection.

### Waste Disposal

Disposal of experimental animals was done based on the policies of Philippine Institute of Traditional And Alternative Health Care (PITAHC). The researchers entrusted the used experimental animals under their care after the study was conducted.

### Ethical Consideration

The gathering of Mackerel scad (*Decapterus macrosoma)* following the protocols provided so as to not cause harm in saltwater fishes. The collection of Mackerel scad- boiling, grinding, and heating, was secured upon the conduct of the study.

The researchers used rats in conducting this study and were responsible for responding effectively for the housing and caring of these testing animals. The researchers were accountable for all possible misconduct and negligence toward the experimental animals. The researchers performed test methods using inducing agent (Methimazole). All protocols that were used in conducting this study were subjected for approval by the ethics committee of University of Saint Louis Tuguegarao, Philippine Institute of Traditional and Alternative Health Care (PITAHC), Bureau of Fisheries and Aquatic Resources (BFAR) and other regional offices.

## RESULTS

**Table 3a.** *Test of Significant Difference on the Level of Thyroid Hormones (T3) before and after the Administration of Treatments on hypothyroidic Albino rats*

| Time | Mean | df | t-value | p - value | Decision |
|---|---|---|---|---|---|
| Before | .6442 | 11 | -4.378 | .001 | Reject Ho |

| | | | | | |
|---|---|---|---|---|---|
| After | .8067 | | | | |

Table 3a shows that there is a significant difference between the level of T3 before and after the administration of treatments. It indicates that the infused treatments are effective in raising the T3 level on hypothyroidic Albino rats.

**Table 3b.** *Test of Significant Difference on the Level of Thyroid Hormones (T4) before and after the Administration of Treatments on hypothyroidic Albino rats*

| Time | Mean | df | t-value | p - value | Decision |
|---|---|---|---|---|---|
| Before | 21.5408 | 11 | -7.536 | .000 | Reject Ho |
| After | 28.3400 | | | | |

Table 3b shows that there is a significant difference between the level of T4 before and after the administration of treatments. It indicates that the infused treatments are effective in raising the T4 level on hypothyroidic Albino rats.

**Table 3c.** *Test of Significant Difference on the Level of Thyroid Hormones (TSH) before and after the Administration of Treatments on hypothyroidic Albino rats*

| Time | Mean | df | t-value | p - value | Decision |
|---|---|---|---|---|---|
| Before | .01 | 0 | | 1 | Accept Ho |
| After | .01 | | | | |

Table 3c shows that there is no significant difference between the level of TSH before and after the administration of treatments.

**Table 4a.** *Test of Significant Difference on the Level of Thyroid Hormones (T3) before and after the Administration of Treatment A on hypothyroidic Albino rats*

| Time | Mean | df | t-value | p - value | Decision |
|---|---|---|---|---|---|
| Before | .6175 | 3 | -2.647 | .077 | Accept Ho |
| After | .7500 | | | | |

Table 4a shows that there is no significant difference on the level of T3 before and after the administration of Treatment A.

**Table 4b**. *Test of Significant Difference on the Level of Thyroid Hormones (T3) before and after the Administration of Treatment B on hypothyroidic Albino rats*

| Time | Mean | df | t-value | p - value | Decision |
|---|---|---|---|---|---|
| Before | .6525 | 3 | -3.773 | .033 | Accept Ho |
| After | .7625 | | | | |

Table 4b shows that there is no significant difference on the level of T3 before and after the administration of Treatment B.

**Table 4c.** *Test of Significant Difference on the Level of Thyroid Hormones (T3) before and after the Administration of Treatment C on hypothyroidic Albino rats*

| Time | Mean | df | t-value | p - value | Decision |
|---|---|---|---|---|---|
| Before | .6625 | 3 | -2.688 | .075 | Accept Ho |
| After | .9075 | | | | |

Table 4c shows that there is no significant difference on the level of T3 before and after the administration of Treatment C.

**Table 5a.** Test of S*ignificant Difference on the Level of Thyroid Hormones (T4) before and after the Administration of Treatment A.*

| Time | Mean | df | t-value | p - value | Decision |
|---|---|---|---|---|---|
| Before | 24.5300 | 3 | -2.911 | .062 | Accept Ho |
| After | 28.8850 | | | | |

Table 5a shows that there is no significant difference on the level of T4 before and after the administration of Treatment A.

**Table 5b.** Test of S*ignificant Difference on the Level of Thyroid Hormones (T4) before and after the Administration of Treatment B.*

| Time | Mean | df | t-value | p - value | Decision |
|---|---|---|---|---|---|
| Before | 20.4875 | 3 | -4.813 | .017 | Accept Ho |
| After | 27.9500 | | | | |

Table 5b shows that there is no significant difference on the level of T4 before and after the administration of Treatment B.

**Table 5c.** Test of S*ignificant Difference on the Level of Thyroid Hormones (T4) before and after the Administration of Treatment C.*

| Time | Mean | df | t-value | p - value | Decision |
|---|---|---|---|---|---|
| Before | 19.6050 | 3 | -8.120 | .004 | Reject Ho |
| After | 28.1850 | | | | |

Table 5c shows that there is a significant difference on the level of T4 before and after the administration of Treatment C.

**Table 6.** *Test of Significant Difference on the Level of Thyroid Hormones (T3) after the Administration of Treatments A, B, C, Positive and Negative Controls on hypothyroidic Albino rats*

| Group | Mean | df | F-value | p - value | Decision |
|---|---|---|---|---|---|
| Treatment A,B,C | .8067 | 2 | 9.115 | .002 | Reject Ho |
| Positive Control | 2.4350 | | | | |
| Negative Control | 1.0875 | | | | |

Table 6 shows that there is a significant difference on the effect of the treatment and control groups on increasing the T3 level of albino rats.

**Table 6a.** *Least Significant Difference on the Level of Thyroid Hormones (T3) after the Administration of Treatments A, B, C, Positive and, Negative Control on hypothyroidic Albino rats*

| Group | Mean | Treatment A | Positive Control | Negative Control |
|---|---|---|---|---|
| Treatment ABC | .8067 | 1 | | |
| Positive Control | 2.4350 | .001* | 1 | |
| Negative Control | 1.0875 | .010 | .473 | 1 |

Table 6a shows that the positive control significantly increased the T3 level of albino rats, as compared with the three treatment groups and the negative control.

**Table 7.1.** *Significant Difference on the Level of Thyroid Hormones (T4) after the Administration of Treatments A, B, C, Positive and, Negative Control on hypothyroidic Albino rats*

| Group | Mean | df | F-value | p - value | Decision |
|---|---|---|---|---|---|
| Treatment ABC | 28.3400 | 2 | 156.426 | .000 | Reject Ho |
| Positive Control | 92.8525 | | | | |
| Negative Control | 32.1625 | | | | |

Table 7 shows that there is a significant difference on the effect of the treatment and control groups on increasing the T4 level of albino rats.

**Table 7.2.** *Least Significant Difference on the Level of Thyroid Hormones (T4) after the Administration of Treatments A, B, C, Positive and, Negative Control on hypothyroidic Albino rats*

| Group | Mean | Treatment A | Positive Control | Negative Control |
|---|---|---|---|---|
| Treatment ABC | 28.3400 | 1 | | |
| Positive Control | 92.8525 | .000* | 1 | |
| Negative Control | 32.1625 | .000* | .570 | 1 |

Table 7.2 shows that the positive and negative controls significantly increased the T4 level of albino rats, as compared with the three treatment groups.

**Table 8.** *Significant Difference on the Level of Thyroid Hormones (TSH) after the Administration of Treatments A, B, C, Positive and, Negative Control on hypothyroidic Albino rats*

| Group | Mean | df | F-value | p - value | Decision |
|---|---|---|---|---|---|
| Treatment ABC | .0100 | 2 | 21.883 | .000 | Reject Ho |

| | | | | | |
|---|---|---|---|---|---|
| Positive Control | 92.8525 | | | | |
| Negative Control | 32.1625 | | | | |

Table 8 shows that there is a significant difference on the effect of the treatment and control groups on increasing the TSH level of albino rats.

**Table 8a.** *Least Significant Difference on the Level of Thyroid Hormones (TSH) after the Administration of Treatments A, B, C, Positive and, Negative Control on hypothyroidic Albino rats*

| Group | Mean | Treatment A | Positive Control | Negative Control |
|---|---|---|---|---|
| Treatment ABC | .0100 | 1 | | |
| Positive Control | 92.8525 | .000* | 1 | |
| Negative Control | 32.1625 | .010 | .009* | 1 |

Table 8a shows that the positive control significantly increased the TSH level of albino rats, as compared with the three treatment groups and the negative control.

**DISCUSSION**

The researchers studied the activity of Mackerel scad (*Decapterus macrosoma*) through their iodine effect by observing the changes of thyroid hormones (T3, T4, and TSH) on the test subjects. Male wistar rats weighing 80-100 grams were used as test subjects.

In the procedure, the researchers used Methimazole as a potential drug for inducing Hypothyroidism on healthy Albino rats. This claim is supported by previous study conducted by Milosevic, M.C., Vukosava, D., Korac,A.,(2014)**.** Male Wistar rats were made hypothyroidic for 22 days through dissolving 0.025% Methimazole on their drinking water. After the induction, blood samples were obtained through rat tail vein collection for the determination of levels of thyroid hormones. Baseline results of the level of thyroid hormones show that the Albino rats were made into Hypothyroidic. Three different treatment doses of *Decapterus macrosoma* were infused on the hypothyroidic animal subjects. The standard drug for Hypothyroidism which is Levothyroxine is used as the positive control for comparison with the iodine activity of *Decapterus macrosoma* in elevating the thyroid hormones.

It is observed that there was an evident increase of thyroid hormones (T3 and T4) before and after the administration of all treatments (A, B, C) and control (Positive and Negative). Treatment A (3mL Fish Flesh Broth and 350mg Powdered Fish Bones), Treatment B (2.25mL Fish Flesh Broth and 700mg Powdered Fish Bones), and Treatment C (1.5mL Fish Flesh Broth and 1050mg Powdered Fish

Bones) evidently increase the level of T3 and T4. However, it is not in a significant amount. Treatment A, B, and C show a comparable results when compared to the Positive control which is Levothyroxine in increasing T3. Treatment C, alone, is the only dose that has the activity to increase the value of T4 to a significant level after its administration to the Albino rats. Treatments A, B, and C show a significant difference when compared with Positive Control in elevating T4 level.

Though there are few studies about treating hypothyroidism, this study shows that *Decapterus macrosoma* Fish Flesh Broth and Powdered Fish Bones have the activity to increase the level of Thyroid Hormones due to its iodine content. Iodine is a rate-limiting element for the synthesis of thyroid hormones. A study claimed by, Chung, H.R.(2014). The highest mean iodine content of processed fish was determined to be 2.149mg in smoked Mackerel scad (Erkan, 2011).

## CONCLUSION

By using the different prepared treatments of Flesh broth and Powdered bones of Mackerel scad *(Decapterus macrosoma)*, the researchers concluded that Treatment A and B is not significant to any treatment for hypothyroidism but is intended only to increase the thyroid hormones especially for T3 and T4. In Treatment C, there was a significant difference from other treatments. Treatment C is consisting of smallest amount of flesh broth and largest amount of powdered bones. Therefore, due to increase level of thyroid hormones after the induction of 1mL of flesh broth and 1,050 mg of powdered bones, Treatment C (1.5mL Fish Flesh Broth and 1050mg Powdered Fish Bones) of Mackerel scad *(Decapterus macrosoma)* has the highest activity in treating Hypothyroidism.

## RECOMMENDATION

Based on the research findings and conclusion, the researchers would like to recommend the following for future studies:

1. Histopathology examination must be included to further diagnose the characteristics and relevant parameters of Hypothyroidism on Albino rats.
2. Administration of the treatments in a long period of time should be considered to attain the most accurate effect of the treatment to rats.

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