

 <p>INNOVATIVE JOURNAL IÖNKIVT</p>	<p>Contents lists available at <a href="http://www.innovativejournal.in">www.innovativejournal.in</a></p> <p><b>INTERNATIONAL JOURNAL OF NURSING DIDACTICS</b></p> <p>Homepage: <a href="http://innovativejournal.in/index.php/ijnd">http://innovativejournal.in/index.php/ijnd</a></p>	 <p>IJND ISSN: 2231-5454</p>
---	---	---

## Effect of Shaker Exercises on Swallowing Disturbance among Patients with Hyperthyroidism at a Selected University Hospital

<sup>1</sup> Dr. Heba Ahmed Mohammed & <sup>2</sup> Dr. Safaa M. Hassanein

<sup>1</sup> Lecturer & <sup>2</sup> Assistant professor of Medical-Surgical Nursing Department, Faculty of Nursing, Cairo University, Egypt

DOI: <https://doi.org/10.15520/ijnd.v9i01.2427>

**Abstract: Background:** Apparently; the most common causes of hyperthyroidism represent in Graves' disease. Shaker Exercises implementation through head lift exercise and tongue strengthening exercises aim to improve motility and strength the muscles of the neck and enhance swallowing capabilities as well. **Aim of the current study** was to examine the effect of shaker exercises on swallowing disturbance among patients with hyperthyroidism at a selected University Hospital, Egypt. **Design:** A quazi-experimental design time series Non-equivalent design was utilized, the study conducted at surgical departments at one of University Hospital; Egypt. **Research hypothesis: H1:** Study group who received the Shaker Exercises will have a significant lower mean swallowing disturbance score than the control group who received only routine hospital care. **H2 (a,b,c & d):** Study group who received the Shaker Exercises will have higher correlation between total swallowing disturbance score and selected related sub-Items than the control group who received only routine hospital care. **Sample:** 60 adult male and female patients divided randomly into two equal groups, control group (n=30 patients) received the routine hospital treatment of the hyperthyroidism, and study group (n=30 patients) received routine hospital in addition to the Shaker Exercises. **Tools: Tool I:** Demographic and medical data sheet. **Tool II:** Swallowing Disturbance Questionnaire (SDQ). **Results:** there was a statistical significant difference among study group comparing to control group regarding the swallowing disturbance after shaker exercise interventions. **Conclusion:** study group patients who received the Shaker Exercise in addition to their routine hospital care "which was medical treatment" was improved significantly comparing to the control group who received only their medical treatment. **Recommendation:** Replicate the study on a larger group to add to solid evidence practice and replicate the study on other disease rather than hyperthyroidism that interfere with swallowing function.

**Key words:** Shaker Exercises, Swallowing disturbance & Hyperthyroidism.

### INTRODUCTION

Functional swallowing is crucial for survival. Safe and efficient swallowing needs an elaborative coordination of neuromuscular activity to allow for the swallowed food to pass from the oropharynx into the esophagus to the stomach without aspiration occurring (DeJong, 2016) [1]. The coordination and strength of this mechanism can be impaired, resulting in swallowing abnormalities or difficulties (Mishra, Rajappa, Tipton, & Malandraki, 2015) [2]. There are several disorders can induce swallowing abnormalities as benign and malignant tumor, that involve either the oropharynx or the esophagus. Additionally, it can be associated with multiple systemic disorders that involve musculoskeletal and/or nervous systems as diabetes mellitus, hyperthyroidism, stroke, lupus erythematosus, Parkinson disease and Alzheimer disease.

Other related diseases affected the swallowing function and lead to swallowing disturbance was defined by the American Thyroid Association (2018) [3] which defined hyperthyroidism as an excessive amount of triiodothyronine (T3) and/or thyroxine (T4). T3 and T4 are thyroid hormones that are essential for regulation of body's metabolism, protein synthesis, and increasing metabolic activity. Knowing that the prevalence of hyperthyroidism is approximately 1.2% in the United States; the excesses amount of thyroid hormones lead to increasing in metabolic rate, which affects most of body systems functions. Apparently; the most common causes of hyperthyroidism represent in Graves' disease (GD), toxic multinodular goiter

(TMNG) and toxic adenoma (TA) (Ross, et al., 2016) [4]. In hyperthyroidism, reports indicate specific cases of dysphagia associated with thyrotoxic myopathy which includes striated muscles of the pharynx and the upper part of the esophagus (Pernambuco, Silva, Almeida, Costa & Souza, 2017) [5]. In addition, direct impingement of oesophagus by enlarging cervical or retrosternal goiter can induce dysphagia (Banday, Bhat, Kmat, Bhat & Nanjundswamy, 2014) [6]. Recently Jansson-Knodell, Codipilly and Leggett, (2017) [7] reported that dysphagia is a fascinating symptom, occurring in approximately 3 percent of the overall population. It is estimated that one in every seventeen individual will struggle with dysphagia at some point in their lives

To be specific; dysphagia is defined as difficult of swallowing and categorized as oropharyngeal or esophageal (Lalsa, 2017) [8]. Oropharyngeal dysphagia is manifested by difficulty initiating a swallow; this may be associated with a sensation of residual food remaining in the pharynx (Fass, 2017) [9]. However, Esophageal dysphagia is difficulty swallowing several seconds after initiating a swallow followed by a sensation of food getting stuck in the esophagus when the food bolus fails to easily transverse the esophagus (Clark, 2015) [10]. Delayed diagnosis and intervention of dysphagia can result in coughing, choking, or a sensation of choking, regurgitation, Frequent heartburn, malnutrition, dehydration, aspiration pneumonia which in turn can increase the rate of mortality of those patients (Voigt, 2014) [11].

Swallowing interventions are applied for dysphagia, varying from compensatory techniques as postural changes and modifications of the diet/bolus to rehabilitative techniques that aim to strengthen the swallowing musculature. Also they included swallowing exercises and non-swallowing exercises. Swallowing exercises are used during the swallow to increase the success of the swallow itself by training the involved muscles such as the effortful swallow. While non-swallowing exercises such as Shaker or head lift exercise and tongue strengthening exercises aim to improve motility and strength the muscles of the neck and enhance swallowing capabilities without limitations that may be imposed during actual swallowing (Kraaijenga, *et al.*, 2017) [12].

Shaker Exercises is a series of sustained and repetitive head lifting exercises to enhance the strength of suprahyoid and infrahyoid muscular activity, reduces pyriform sinus residue and backflow aspiration and also improves swallowing functions (Babu, Balasubramaniam & Varghese, 2017) [13]. Shaker exercise includes isometric and isotonic exercises. Isometric exercises are performed by keeping the shoulder flat and raising the head up for a minute followed by sixty seconds rest for a repetition of 3 times. Followed by this, isotonic exercises are performed by 30 repetitions of alternate up-and-down movement of the head. This strengthens the suprahyoid muscles, enhances the contraction of the thyrohyoid muscle, facilitates the upward and forward movement of the larynx, and thereby opens the upper esophageal sphincter so improve swallowing abilities (Park, Hwang, Oh & Chang, 2017) [14], (Kim, Lee, Lee & Rhu, 2015) [15] and (DeJong, 2016) [1].

Shaker exercise is currently the most commonly recommended swallowing exercise by speech-language pathologists for the treatment of dysphagia and based on different studies done for different patients have different disorders as head and neck cancer, stroke and parkinson disease reported that shaker exercise is effective to reduce intensity of dysphagia and improve swallowing abilities but there is no enough researches or scanty number of researches have been conducted to investigate the effect of shaker exercise on dysphagia among patients with hyperthyroidism (Kraaijenga, *et al.*, 2017) [12], (Park, Hwang, Oh & Chang, 2017) [14], (Langmore & Pisegna, 2015) [16], (DeJong, 2016) [1] and (Jones, Knigge & McCulloch, 2014) [17].

The researchers emphasize the fact that it is very essential for health care professionals and in particular nurses, to identify the complications of dysphagia in patients with hyperthyroidism. It is also important that nurses are able to recognize the signs and symptoms of dysphagia and facilitate proper intervention for this condition. This could improve the swallowing function outcome for patients with hyperthyroidism. In addition, the nurses should have the ability to assess the intensity of dysphagia by standardized tool and to be able to apply shaker exercise effectively and measure its effectiveness to reduce dysphagia and improve swallowing abilities among patients with hyperthyroidism. Therefore, in this study, the researchers are interested to elicit the effect of Shaker Exercises on swallowing disturbance among patients with hyperthyroidism at a selected university hospital.

## THEORETICAL FRAMEWORK

The theoretical framework for this study was derived from Ida Jean Orlando, theory of deliberative nursing process. It demonstrates that patient improvement resulted from a deliberative nursing process. This theory has three components such as patient behavior, nurse's reaction and nurse's activity. The patient's behavior may be verbal or non-verbal behavior (Wayne, 2014) [18]. In this study the patient's verbal complaints include discomfort due to pain during swallowing, feeling of a lump in the throat and hoarseness or voice problems. Non-verbal behavior includes difficulty in swallowing liquids and solids, cough during swallowing. In relation to nurse's reaction composed of three sequential parts as perception, thought and feelings. The researchers perceived that the inability of patients to swallow properly (dysphagia) leads to automatic thought of the assumptions such as swallowing exercises as shaker exercise can strengthen muscles and increase swallowing ability and improve nutritional status in hyperthyroidism.

Moreover nurse's activity includes two approaches: automatic or deliberative actions. Automatic actions were primarily concerned with carried out routine care and protection of health. Hence the researchers keep the patients receiving the routine measures of dysphagia intervention according to the hospital policy for the control group. Deliberative actions are those nursing actions decided upon further ascertaining a need and then meeting the particular need. The researchers assess the swallowing abilities of patients with hyperthyroidism and demonstrate shaker exercises for the study group. Finally the researchers' activities include post assessment of swallowing ability after shaker exercise which might improve their swallowing disturbance. If improvement happens on the outcome variable such as ability to swallow liquids and solids, improved nutritional status could be achieved (Rani, Porkodi & Seethalakshmi, 2013) [19].

## SIGNIFICANCE OF THE STUDY

Based on a systematic review conducted by Al Shahrani, *et al.*, (2016) [20]; found that 25.25% have hyperthyroidism in Egypt. Also; American Thyroid Association (2017) [21] reported that around 20 million Americans; experience thyroid disease. In addition to the millions who have some form of thyroid disease and it is estimated that more than 12 percent of the American Population will develop a thyroid condition during their lifetime.

Besides the hyperthyroidism symptoms as fatigue, depression, forgetfulness, irregular menses; difficulty in swallowing considers one of those irritant symptoms which dramatically could lead to weight loss on the long term. Apparently those patients receive their medical treatment to improve their medical condition; while it was found that related swallowing exercise could improve the dysphasia condition for those patients which might help in reducing the weight loss process. Hyperthyroidism exhibit reducing in the upper esophageal sphincter opening; shaker swallowing exercise evidenced that it improves this pathological condition. As Langmore & Pisegna, (2015) [16] found that change and improve the swallowing

physiology in force, speed or timing, and also produce long term effect. Moreover, related swallowing exercises as Shaker Head Lift Exercise Strength Training had positive results and high-quality evidence from randomized control trials (RCTs) and also have a benefit to reduce the incidence and severity of dysphagia. So it was relevant to examine the effect of Shaker Exercises among patients with hyperthyroidism; specially there is no enough research have been conducted on the improvement of patient with that disease so; hoping that the result of the current study improve their swallowing and eating condition and add to nursing body of knowledge and practice as well.

## SUBJECTS & METHODS

### *Aim of the study:*

The aim of the current study was to examine the effect of Shaker Exercises on swallowing disturbance among patient with hyperthyroidism at a selected university hospital.

### *Research hypotheses:*

- **H1:** Study group who received the Shaker Exercises will have a significant lower mean swallowing disturbance score than the control group who received only routine hospital care.
- **H2:** Study group who received the Shaker Exercises will have higher correlation between total swallowing disturbance score and selected related sub-Items than the control group who received only routine hospital care; *as follows:*
  - H2.a: Study group who received the Shaker Exercises will have higher correlation between total swallowing disturbance score and swallowing solid food difficulty than the control group who received only routine hospital care.
  - H2.b: Study group who received the Shaker Exercises will have higher correlation between total swallowing disturbance score and coughing during solid food swallowing than the control group who received only routine hospital care.
  - H2.c: Study group who received the Shaker Exercises will have higher correlation between total swallowing disturbance score and voice changing during eating/drinking than the control group who received only routine hospital care.
  - H2.d: Study group who received the Shaker Exercises will have higher correlation between total swallowing disturbance score and breathing difficulty/coughing during saliva swallowing than the control group who received only routine hospital care.

### *Research design:*

A quazi-experimental/interrupted time-series design with nonequivalent group design was utilized to guide and achieve the aim of the current research. As Paul, Rajiv, Chiang, Leighton & Cuttler (2017) [22], mentioned that this design is a way to improve upon the interrupted time-series design is to add a control group. It involves taking a set of measurements at intervals over a period of time both before and after an intervention of interest.

### *Setting:*

The study was conducted at the surgical departments at a selected University Hospital; Egypt.

### *Subjects:*

Over 6 consecutive months; a convenient sample of 64 adult male & female patients was included, 4 patients was dropped out of the study as follow-up could not be achieved, so 60 adult patients was remain till the end of the study. The study was (from August-2018 to January-2019). The inclusion criteria were as follows: 1) Patients diagnosed with hyperthyroidism, preoperative and have difficulty on swallowing either liquid or soft/hard food or both. The sample divided randomly into two equal groups, control group (n =30 patients) received the routine hospital treatment of the hyperthyroidism, and study group (n =30 patients) received routine hospital in addition to the Shaker Exercises. Study and control groups' sample homogeneity was maintained. While the exclusion criteria: Based on Shaker Exercises instruction; the study excluded the patients with cardiac problems or Cervical spine problems, patients with neck problems (e.g.- arthritis), lack of cognition, patients who could not lift their head up and/or flex the neck, also who unable to exercise independently; as they may not be able to perform this exercise.

### *Tools:*

In order to achieve the aim of the current research two tools were utilized to gather data pertinent to the study variables as follows:

**Tool I:** Demographic and medical data sheet: it consisted of items seeking information about the background of the subjects such as age, gender, marital status, occupation & medical diagnosis as laboratory investigation...etc.

**Tool II:** Swallowing Disturbance Questionnaire (SDQ); aims to assess swallowing difficulty. It consists of 15 questions. Question 1 to 14 on a scale of 0=Never, 1=Seldome, 2=Frequently and 3=Very frequently, while question 15 is either 0=no or 1=yes. SDQ Questions are related to experience difficulty chewing solid food, difficulty in swallowing solid food...etc. The reliability of SDQ was established as the total SDQ score correlated with the total oromotor scores with 79.7% sensitivity (Manor & Cohen , 2011) [23].

### *Ethical consideration:*

An official permission was taken from the hospital administrators. Each participant was informed about the nature and purpose of the study. Then consent was obtained from all patients to participate in the study. The researchers emphasized that participation in the study is entirely voluntary; anonymity and confidentiality are assured though coding the data. Moreover, the intervention used in the current study is safe. By the end of the study the control study group has been given the Shaker Exercises to ensure justice

### *Pilot study:*

Once permission was granted to proceed with the proposed study, a pilot study was carried out before starting data collection on 6 of targeted patients to evaluate the clarity, feasibility and applicability of the tools as well as estimate the time needed to collect data. Also panel of three juries'

expertise were review the utilized tools for its validity. The used tools were valid and reliable.

**Procedure:**

**The Preparatory phase:** Initially the patients with hyperthyroidism and has been fulfilled the inclusion criteria and confirmed to have difficulty in swallowing starting from the seldom level would enrolled in the current research; by using simple random sample method, patients would distributed to be either in the control or at the study group. Both study and control groups after fully explanation of the study's nature and ensure their acceptance in sharing in the current research; the demographic data and Swallowing Disturbance Questionnaire was used to assess their swallowing condition for both groups.

**The Implementation Phase:** The control group would take only their routine hospital care of the hyperthyroidism management which the researchers figured it out that it was only medical treatment; while the study group would take the Shaker Exercises beside their medical treatment. The aim of that exercise is to strengthen muscles of the neck in order to facilitate opening of the upper esophageal sphincter so improve swallowing abilities through two parts as evidenced by Shaker, et al., 2002) [24].

The researchers taught each patient individually and several times by using flyer including simulated pictures; also each patient demonstrate the following steps in front the researchers; as follows: **First part:** 1. Lie flat on the back with no pillow under the head. 2. Lift the head to look at the toes. 3. Keep the shoulders flat on a solid object. 4. Hold this position for 60 seconds. 5. Release and repeat 3 times and rest 1 minute between repetitions. **Second Part:** Lift and Lower (same starting position as sustained hold) 1. Lift the head and look at his toes. 2. Let the head go back down with control. 3. Repeat 30 times. 4. Rest in between as needed. After each patient was mastering the above mentioned steps the researchers asked the patients to repeat the **First** and **Second** parts 3 times a day over a whole week. And this was under the researchers monitoring and follow up by face to face and by phone if any patient had a question.

**The Evaluation phase:** Actually based on the critical review which have been conducted by Dejong (2016) [1] Shaker Exercises has an immediate positive effect after the first intervention but in order to maintain enough prolonged improvement period; the second measurement was after three days of administering the Shaker Exercises by using Swallowing Disturbance Questionnaire then the third measurement would be after another four days/ a week from the base line reading/before discharge or before the thyroidectomy procedure. While for the control group would take the measurements at the same interval of the study group.

**Operational Definition:**

**Swallowing Disturbance:** For the current study, any patients with hyperthyroidism who reported that he/she had difficulty in swallowing liquid/soft, hard food or saliva and had score of seldom level by using Swallowing Disturbance Questionnaire (Manor & Cohen, 2011). [23]

**Statistical analysis:**

The data was coded and tabulated using a personal computer. Statistical Package for Social Science (SPSS) version 20 was used. Data was presented using descriptive statistics in the form of frequencies and percentage. T-test was utilized as an inferential statistics to compare means between study and control groups in relation to research variables, chi-square test was used to identify relationship between qualitative variables and ANOVA test also was used. Statistical significance was considered at P-value  $\leq$  0.05.

**RESULTS**

Statistical findings of the current study are presented in three sections as following: **Section 1:** Describes Personal demographic characteristics and Medical data of the study and control groups (Tables 1-2) and (Figures 1, 2 and 3). **Section 2:** Delineates the 1<sup>st</sup> hypothesis testing of compare of means regarding swallowing disturbance score among the study and the control groups (Tables 3, 4). **Section 3:** Clarifying the 2<sup>nd</sup> hypothesis (a,b,c & d) testing for being supported as relationship between total swallowing disturbance score and selected related sub-Items among study and control groups (Table 5).

**Section 1: Demographic characteristics and Medical data of the study and control groups**

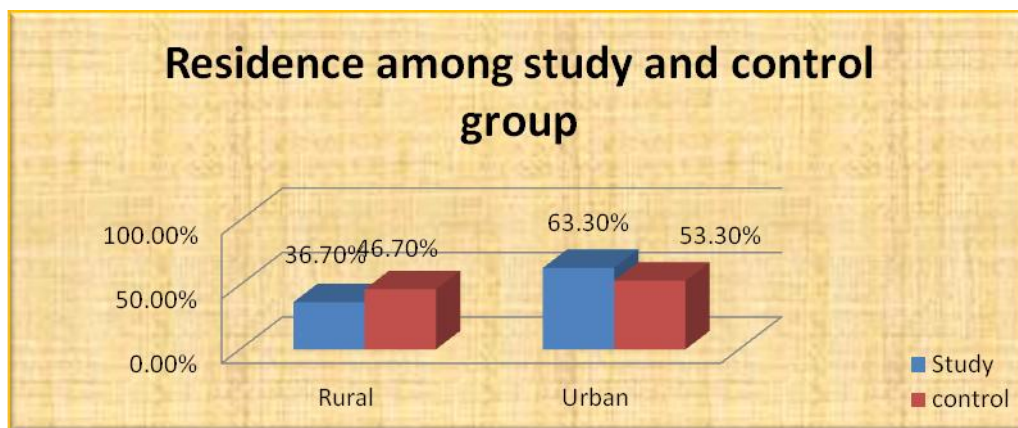
**Table (1): Personal demographic characteristics of study and control group (n= 60).**

Variables	Study group n=30		Control group n=30		$\chi^2$	P- value
	No.	%	No.	%		
<b>Age:</b>					1.163	0.762
1. 20 yrs < 30 yrs	8	26.7%	9	30.0%		
2. 30 yrs < 40 yrs	7	23.3%	4	13.3%		
3. 40 yrs < 50 yrs	9	30.0%	9	30.0%		
4. 50 yrs < 60 yrs	6	20.0%	8	26.7%		
<b>Mean <math>\pm</math> SD</b>	38.17 $\pm$ 11.618		38.90 $\pm$ 11.616			
<b>Gender:</b>					0.162	0.688
1. Male	3	10.0%	4	13.3%		
2. Female	27	90.0%	26	86.7%		
<b>Education Level:</b>					3.635	0.603
1. Can't read or write	3	10.0%	2	6.7%		
2. Can read and write	4	13.3%	4	13.3%		
3. Primary School	5	16.7%	8	26.7%		
4. Secondary	4	13.3%	1	3.3%		
5. Deplome	9	30.0%	7	23.3%		
6. Bachelor	5	16.7%	8	26.7%		
<b>Occupation:</b>					1.430	0.489
1. Does not work	4	13.3%	2	6.7%		
2. Employee	6	20.0%	4	13.3%		
3. Casual Work	20	66.7%	24	80.0%		
<b>Smoking</b>					0.218	0.640
1. Yes	2	6.7%	3	10.0%		
2. No	28	93.3%	27	90.0%		
<b>Family history of hyperthyroidism.</b>					0.577	0.448
1. Yes	3	10.0%	5	16.7%		
2. No	27	90.0%	25	83.3%		

\* Significant  $\leq 0.05$

Table (1) Firstly, it shows study and control matched/homogeneity groups as there was no mean of difference which equal  $38.17 \pm 11.618$  and  $38.90 \pm 11.616$  respectively. In relation to age, (53.3 %) and (43.3 %) of the study and control groups had age ranged between 30 to less than 50 years with mean age ( $38.17 \pm 11.618$ ) for the study group, and ( $38.90 \pm 11.616$ ) for control group. Female gender represents (90.0 %) of the study group and (86.7 %) of control group. According to education level (30.0 %) of

the study group were had deplome and (26.7%) of control groups had primary school and bachelor. With reference to occupation, (66.7%) of the study group and (80.0%) of control group had casual work. In addition around (90.0%) of both groups had no family history of hyperthyroidism and non smokers, with no significant statistical differences between study and control groups in relation to demographic data.



**Figure (1) Percentage distribution of residence among study and control groups (n=60)**

Figure (1) represents that (63.30%, 53.30% respectively) of both study and control group had reside urban areas respectively. In addition, there was no statistical significant

difference between both groups ( $\chi^2 = 0.617$ , p-value=0.432); which reflected matched/homogeneity groups

**Table (2): Medical data of both study and control group (n= 60).**

Variables	Study group n=30		Control group n=30		$\chi^2$	P- value
	No.	%	No.	%		
<b>Blood pressure:</b>						
1. Normal	24	80.0%	20	66.7%	1.506	0.471
2. Hypertension	1	3.3%	1	3.3%		
3. Systolic Hypertension	5	16.7%	9	30.0%		
4. Diastolic Hypertension	0	0%	0	0%		
<b>Pulse rate:</b>						
1. Normal	26	86.7%	20	66.7%	3.354	0.067
2. Tachycardia	4	13.3%	10	33.3%		
<b>Mean ± SD</b>	89.50 ± 10.368		91.17 ± 13.307			
<b>Do you know having hyperthyroidism:</b>						
1. Yes	23	76.7%	23	76.7%	0.000	1.000
2. No	7	23.3%	7	23.3%		
<b>Hyperthyroidism Medication</b>						
1. Tapazole	17	56.7%	12	40.0%	1.669	0.196
2. Did not know	13	43.3%	18	60.0%		
<b>Thyroid function test :</b>						
1- T3					0.601	0.606
- Normal	14	46.7%	17	56.7%		
- Hyper	16	53.3%	13	43.3%		
2- T4						
- Normal	2	6.7%	0	0%	2.069	0.150
- Hyper	28	93.3%	30	100%		
3- TSH					2.069	0.150
- Normal	2	6.7%	0	0%		
- Hypo	28	93.3%	30	100%		

\* Significant ≤ 0.05

Table (2) shows that (80.0%, 66.7% respectively) of both study and control group had normal blood pressure. (86.7%, 66.7% respectively) of both study and control group had normal pulse rate. (76.7%) of both groups did know had hyperthyroidism. Moreover, (56.7%) of the study group were receive tapazole and (60%) of control group didn't know the names of the drugs. (53.3%) of the study group

were had elevated T3. While (56.7%) of the control group were had normal T3. (93.3%, 100% respectively) of both study and control group had elevated level of T4 and low level of TSH. In addition, there was no statistical significant difference between both groups; which reflected matched/homogeneity groups.

**Table (3): Medical data of both study and control group (n= 60) (cont.).**

Variables	Study group n=30		Control group n=30		$\chi^2$	P- value
	No.	%	No.	%		
<b>Other lab. Investigation</b>						
1- Na					1.079	0.583
- Normal	6	20%	8	26.7%		
- Hyper	16	53.3%	12	40.0%		
- Not measured	8	26.7%	10	33.3%		
2- K					0.317	0.573
- Normal	22	73.3%	20	66.7%		
- Not measured	8	26.7%	10	33.3%		
3- Ca					0.317	0.573
- Normal	22	73.3%	20	66.7%		
- Not measured	8	26.7%	10	33.3%		
- <b>Number of daily meal</b>						
1. Two meals	7	23.3%	12	40.0%	1.926	0.165
2. Three meals	23	76.7%	18	60.0%		
- <b>Modification of meal texture</b>						
1. No	25	83.3%	25	83.3%	0.000	1.000
2. Yes	5	16.7%	5	16.7%		
- <b>Body Mass Index</b>						
1. Normal	7	23.3%	7	23.3%	0.119	0.942
2. Mild obesity	17	56.7%	18	60.0%		
3. Moderate obesity	6	20.0%	5	16.7%		
<b>Mean ± SD</b>	27.3183 ± 3.434		26.9450 ± 3.731			
- <b>Number of kilo loss</b>						
1. 0-5	9	30%	12	40.0%	1.962	0.580
2. 6-10	17	56.7%	13	43.3%		
3. 11-15	4	13.3%	4	13.3%		
4. 16-20	0	0%	1	3.3%		
<b>Mean ± SD</b>	8.33 ± 4.221		7.67 ± 5.040			

\* Significant ≤ 0.05



Table (3) also clarifies that (53.3%, 40.0% respectively) of both study and control group had hypernatremia. (73.3%, 66.7% respectively) of both study and control group had normal potassium and calcium level. (76.7%, 60.0% respectively) of both groups receive three meals per day. Moreover, (83.3%) of both groups did not modify their meal

texture. (56.7%, 60.0% respectively) of both study and control group had mild obesity and (56.7%, 43.3% respectively) of both groups loss about 6 to 10 kilo gram from their body weight. In addition, there was no statistical significant difference between both groups; which reflected matched/homogeneity groups.

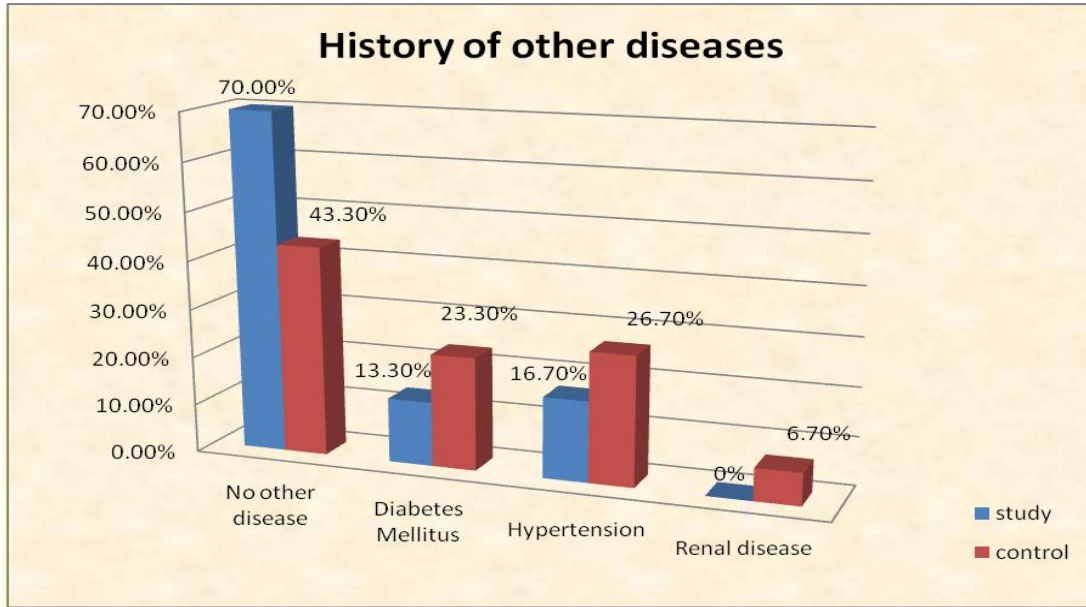


Figure (2) percentage distribution of other diseases history among study and control groups (n=60)

Figure (2) represents that (70.0%, 43.30% respectively) of both study and control group had no other disease. In

addition, there was no statistical significant difference between both groups ( $\chi^2 = 5.393$ , p-value=0.145).

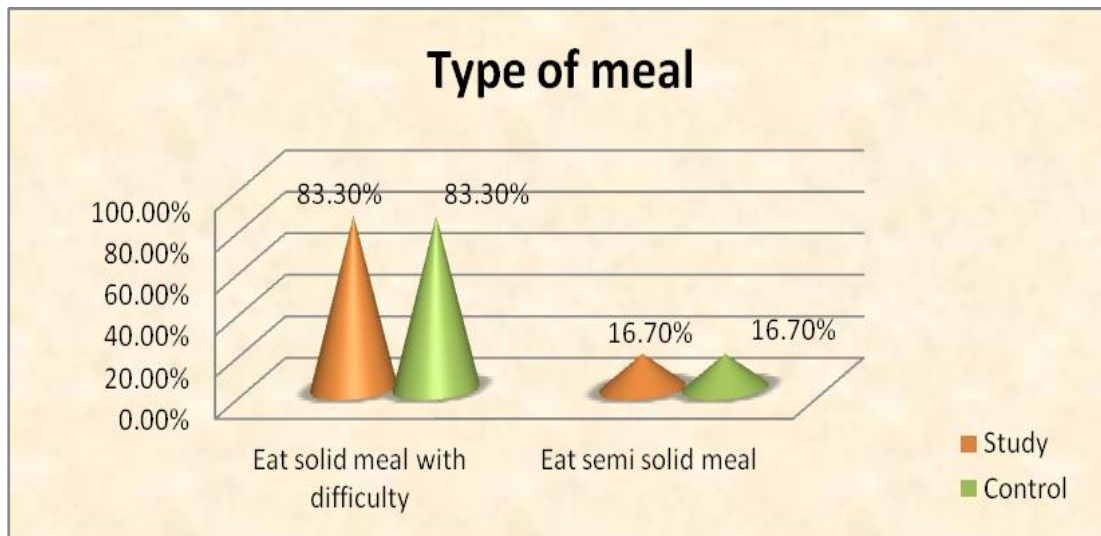


Figure (3) percentage distribution of type of meal among study and control groups (n=60)

Figure (3) clarifies that (83.30%) of both study and control group eat solid meals with difficulty. In addition, there was

no statistical significant difference between both groups ( $\chi^2 = .000$ , p-value=1.000).

**Section 2: Delineates 1<sup>st</sup> hypothesis testing of compare of means for being supported or not (Tables 3-4).**

**Table (4) Percentage and categorical distribution of dysphagia level among study and control groups (n=60)**

Variable	Study group n=30		Control group n=30		$\chi^2$	P-value
	No.	%	No.	%		
- Dysphagia level before intervention					2.852	0.240
▪ No dysphagia	0	0%	0	0%		
▪ Seldom dysphagia	1	3.3%	0	0%		
▪ Frequently dysphagia	6	20%	11	36.7%		
▪ Very frequently dysphagia	23	76.7%	19	63.3%		
- Dysphagia level Post (1)					6.773	0.034*
▪ No dysphagia	0	0%	0	0%		
▪ Seldom dysphagia	3	10%	2	6.6%		
▪ Frequently dysphagia	17	56.7%	8	26.7%		
▪ Very frequently dysphagia	10	33.3%	20	66.7%		
- Dysphagia level Post (2)					30.783	0.000**
▪ No dysphagia	0	0%	0	0%		
▪ Seldom dysphagia	21	70%	2	6.6%		
▪ Frequently dysphagia	9	30%	14	46.7%		
▪ Very frequently dysphagia	0	0%	14	46.7%		

\*Significant at the  $\leq 0.05$

Post (1): After 3 days of intervention & Post (2): One week after intervention

Table (3) shows that (76.7%, 63.3% respectively) of both study and control group had very frequently dysphagia before intervention; with no statistical significance difference between study and control groups which maintained groups homogeneity as  $\chi^2=2.852$ . While (56.7%) of the study group had frequently dysphagia and (66.7%) of control group had very frequently dysphagia after 3 days of

intervention; with statistical significance difference between study and control groups as  $\chi^2=6.773$ . After one week of intervention, (70.0%) of the study group had seldom dysphagia and (46.7%) of control group had frequently dysphagia and very frequently dysphagia; with statistical significance difference between study and control groups as  $\chi^2= 30.783$

**Table (4): Comparison of mean scores of dysphagia before and after intervention of shaker exercises among study and control groups (n=60)**

Items	Study group n=30 Mean $\pm$ SD	Control group n=30 Mean $\pm$ SD	t-test	p-value
Pre intervention	31.17 $\pm$ 5.814	30.60 $\pm$ 5.556	0.386	0.701
Post intervention (1)	25.87 $\pm$ 5.770	29.30 $\pm$ 6.380	2.186	.033*
Post intervention (2)	11.43 $\pm$ 3.766	28.0 $\pm$ 6.465	12.128	.000**
ANOVA test P- value	218.917 0.000**	18.045 0.000***		

\*Significant at the  $\leq 0.05$

Post (1): After 3 days of intervention & Post (2): One week after intervention

**Table (4):** there was a statistical significant mean of difference among study and control group (ANOVA test: 218.917 and 18.045, p-value: 0.000) respectively along the study period. In addition, there was no statistical significant

difference between study and control groups before intervention. While, there was a statistical significant difference between study group when compared to control group in the post 1 and post 2 interventions.

**Section 3: Clarifying 2<sup>nd</sup> hypothesis (a,b,c & d) testing for being supported as relationship between total swallowing difficulty score and selected related sub-Items among study and control groups (Table 5).**

**Table (5): Correlation between difficulty swallowing total score and selected related sub-items (n=60)**

Difficulty swallowing Sub-Items	Study group n=30			Control group n=30		
	Total Score			Total Score		
	1 <sup>st</sup> reading	2 <sup>nd</sup> reading	3 <sup>rd</sup> reading	1 <sup>st</sup> reading	2 <sup>nd</sup> reading	3 <sup>rd</sup> reading
-Swallowing solid food difficulty	0.46 P=0.01*	0.41 P=0.02*	0.72 P=0.000**	0.49 P=0.005*	0.55 P=-0.00*	0.60 P=0.000**
-Coughing during solid food swallowing	0.24 P=0.18	0.39 P=0.03*	0.52 P=0.003**	0.43 P=0.01*	0.53 P=0.00**	0.37 P=0.03*
-Voice changing during eating/drinking	0.34 P=0.06*	0.30 P=0.1	0.56 P=0.001**	0.367 P=0.046*	0.45 P=0.01*	0.41 P=0.02*
-Breathing difficulty /coughing during saliva swallowing	0.28 P=0.13	0.57 P=0.000**	0.31 P=0.09*	0.404 P=0.027*	0.25 P=0.16	0.30 P=0.10

\*\*Significant at the  $\leq 0.05$



The above table showed that, there was positive correlation over the 3 readings between the total difficulty swallowing score and swallowing solid food difficulty and with other valuable related scale sub-items among study group comparing to the control group. Mostly; it was clear with swallowing solid food difficulty as it was strong correlation 0.72 at the 3<sup>rd</sup> reading among study group comparing to moderate correlation 0.60 at 3<sup>rd</sup> reading among control group. Regarding other additional data correlation; there was positive moderate correlation with voice changing during eating and drinking specially at the 3<sup>rd</sup> reading =0.56 comparing to 0.41 at the 3<sup>rd</sup> reading among the control group.

## DISCUSSION

The thyroid gland allocated in the neck; has a butterfly shape. The hormones that it produces and releases into the bloodstream; control the body's growth and metabolism. Too much hormone can affect many functions in the body. There are several possible causes and a wide range of potential symptoms. It usually begins slowly, but in younger people; onset can be sudden. It affects women more than men and is most likely to occur over the age of 60 years. Medication can usually normalize hormone levels, but treatment may take 1 to 2 years. Hyperthyroidism cause several signs and symptoms as fatigue, irritability.....etc and swelling in the neck caused by an enlarged thyroid gland or goiter which interferes with swallowing function. (Nordqvist, 2017) [25].

In the delight of Ida Jean Orlando the researchers apply the Shaker Exercise in order to improve the swallowing difficulty as Ida Jean Orlando mainly focused on developing her Deliberative Nursing Process that allows nurses to formulate an effective nursing care plan that can also be easily adapted when any complexity come up with the patient. She focused on the effort to meet the individual's need for help which are carried out in an interactive situation and in a disciplined manner that requires proper training (Wayne, 2014) [18]. And this was the guidance which the researchers follow it by applying Shaker Exercises for patients with hyperthyroidism.

Apparently the following discussion represented in three main parts. First part represented the demographic and their medical data results; while the second part represented the first related hypothesis that "Study group who received the Shaker Exercises will have a significant lower mean swallowing disturbance score than the control group who received only routine hospital care" and finally the third part discussed the second related hypothesis that " Study group who received the Shaker Exercises will have higher correlation between total swallowing disturbance score and selected related sub-items; (swallowing solid food difficulty, coughing during solid food swallowing, voice changing during eating/drinking, breathing difficulty/coughing during saliva swallowing) than the control group who received only routine hospital care".

First part is related to the demographic and medical data results, the current study revealed that inspite the hyperthyroidism is a serious illness in the old age but the

current study revealed that around half of both study and control groups; there age were between thirty and less than fifty years old while the majority of the study was females and at the same time was a revelation result that they had no hyperthyroidism family history. Dowshen (2015) [26] congruent with the current findings as eventually, the thyroid gland enlarges, are much more common in women and are most likely to occur in teens, young and middle-aged adults. On the other hand a study conducted by Samuels (2018) [27] found diverse result that in the general population in the UK of around 2.7% in females (10-fold less in males) and of undiagnosed disease in around 0.5% of women and added that more recent population-based survey in the United States revealed a prevalence result that hyperthyroidism has no difference between men and women.

Regarding of both study and control groups most of them had normal blood pressure and pulse rate; probably it was under control as they were undertaken their medication which control their vital signs parameters. More than half of the study group was receive tapazole but for control group they did not know the drugs' names. In spite of taking the medication the researchers found that more than half of the study group was had elevated T3 but the control group had normal T3. While the majority of both study and control group had elevated level of T4 and low level of TSH. In addition, that inspite of that result there was no statistical significant difference between both groups; so groups' homogeneity has been maintained. A recent report by Myo Clinic Staff (2019) [28] supported the current research findings as they reported that Anti-thyroid medications gradually decrease symptoms of hyperthyroidism by preventing thyroid gland from producing excess amounts of hormones. It includes methimazole (Tapazole) and propylthiouracil. Symptoms as hypertension...etc usually symptoms begin to improve within several weeks to months. Unfortunately most of the current study patient did not know that they have hyperthyroidism until the official diagnosis; the researchers interpret that as those patients might did not know enough information about the symptoms of hyperthyroidism or as mentioned before that the majority of the current studied sample was female; they ignored all these symptoms in the sake of sacrificing of their family members.

The current study found that merely half of both study and control group had hypernatremia; but around the majority of them had normal potassium and calcium level. The researchers return this as logical consequence as those patients suffer from hyperthyroidism and the thyroid hormones plays a vital role in electrolyte regulation and some of the studied sample just begun to take their thyroid medication so it was expected that it will take time until electrolyte regulation achieved. Actually it was hardly to find a study related to hyperthyroidism and electrolytes disturbance especially for patients' undertaken medication; but a study performed by Schwarz, Leichte, Arampatzis and Feidler (2012) [29] discovered that disorders of thyroid function are considered to be a cause of electrolyte disorders. However only few data on the association between thyroid function and electrolyte disorders already

exists. Also they added that hyponatraemia was present in 14% of patients with high TSH and was significantly more common than in the patients with normal TSH levels of which 9% had hyponatraemia

The most of both groups received three meals per day but the majority of them did not modify their meal texture. But the researchers found that around quarter of the both groups modified their meals to be semi solid which considers a positive step from their side to accommodate with swallowing difficulty. Also the current study revealed that more than half of both study and control groups had mild obesity but at the same time merely the half of the both groups loss about 6 to 10 kilo gram from their body weight over their illness journey. The researchers interpreted that inspite they still obese but they lose weight comparing to before hyperthyroidism condition as a result of disease consequences.

Moreover the second part; related to the first hypothesis which hypothesized that Study group who received Shaker Exercises will have a significant lower mean swallowing disturbance score than the control group who received only routine hospital care". The study revealed that there was no statistical significance difference between study and control groups which maintained groups matching regarding the initial reading. While both study and control groups after 3 days and one week after intervention; had statistical significance difference when comparing between study and control groups regards different dysphagia categories; which have been focused on no "dysphagia, seldom dysphagia, frequently dysphagia and very frequently dysphagia". Same findings regarding the total mean scores of dysphagia before intervention, after 3 days and one week after intervention; between both study and control groups had statistical significance mean scores of difference which obviously increase after one week of the study group.

In fact; the current result disclosed that patients in the study group who trained on Shaker Exercises in addition to their hospital care have been improved more than the control group who received the hospital care only which mainly focused on the medical treatment without any related swallowing exercise. This gave optimistic results for patients with hyperthyroidism; that related swallow exercises improved study group swallowing disturbance score condition and it might improve their general health condition on the long term and control their weight loss as well; as they start to eat their meals. A study has been performed by Mepani, et al., (2009) [30] who supported the current findings which revealed that earlier studies of the effect of 6 weeks of the Shaker Exercise have shown significant increase in opening and anterior excursion of larynx and hyoid during swallowing in patients with upper esophageal sphincter dysfunction, resulting in elimination of aspiration and resumption of oral intake; also they added that after completion of therapy, the percent change in thyroid distance in the Shaker Exercise group was significantly greater compared to the traditional therapy ( $p = 0.034$ ). Another study congruent with the same research findings was performed by Logemann, et al., (2009) [31] which reported that The Shaker Exercises significantly reduced swallow difficulty to a greater degree than the

traditional therapy; as Shaker therapy had a significant increase from pre- to post-therapy.

Finally; the third part is related to the second hypothesis discussion which hypothesized that "Study group who received the Shaker Exercises will have higher correlation between total swallowing disturbance score and selected related sub-items than the control group who received only routine hospital care". The current study revealed that; there was a strong positive correlation between total disturbance swallowing score and swallowing solid food difficulty. Additionally it discovered positive correlation of voice changing during eating/drinking, coughing during solid food swallowing, breathing difficulty/coughing during saliva swallowing with the total swallowing disturbance score after performing Shaker Exercises. The researchers relate this positive finding as Shaker Exercises working positively on training the swallowing muscles to empower its strength which improve the swallowing function especially for solid food and at the same time working efficiently to minimize the opportunity of aspiration occurrence by reducing the coughing during swallowing.

A similar study supported the current finding; which have been performed by Suman, Manzoor, Azmat, Ibrahim and Tahir (2015) [32] on patients with dysphagia with different causes that have been interfered against swallowing function by narrowing esophagus sphincter through compression; those patients had been trained on the swallowing exercise by the end of their study; they revealed that there was improvement in clearing food out of mouth after receiving the exercise as 95% reported that swallowing exercises worked for improvement; 85% reported wet/gurgly voice quality improved as well after exercise and no voice change after swallowing while coughing/choking decreased to be 90% had no complain. Also another recent study by Babu, Balasubramaniam and Varghese (2017) [13] found result which congruent with the recent study as their study's results revealed significant differences of swallows sound with modified Shaker Exercise when they compared to non effortful swallow.

Apparently the current study proofed that Shaker Exercises beside medical treatment of the hyperthyroidism had a positive effect among the study group comparing to the control group who received only the hospital routine care which unfortunately was only the medical treatment. Dejong (2016) [1] supported this conclusion after reviewing the published evidence on the efficacy of Shaker Exercises in rehabilitating swallowing function related to dysphagia as a result of several illnesses which interfere against swallowing function and supported that; the Shaker Exercises was the exercise that most commonly recommended for the treatment of dysphagia. And it reflects the recommendation for best practice guidelines for health team dealing with patients that have dysphagia. Hopefully the result of the current study could act as an additional corner stone in nursing evidence practice related to patients with hyperthyroidism suffering from dysphagia

## CONCLUSION OF THE STUDY

The current study concluded that the current study revealed that study group patients who received the Shaker Exercises

in addition to their routine hospital care "which was medical treatment" was improved significantly comparing to the control group who received only their medical treatment. Several patients of the study group reported that they can eat easily especially the solid food after practicing Shaker Exercises.

#### LIMITATION OF THE STUDY

1. The patients with hyperthyroidism were admitted to be in-patient maximum one week prior the surgical procedure otherwise follow-up would be extended.
2. There was no laboratory investigation follow-up for patients with hyperthyroidism as T3, T4...etc.
3. It was hardly to find the accurate foot scale.

#### RECOMMENDATION OF THE STUDY

Based on the study results, the following recommendations were concluded:

- 1- Replicate the study on a larger group; selected from different geographical areas in Egypt to obtain more generalized findings in relation to the current study.
- 2- Replicate the study on other diseases rather than hyperthyroidism which interfere with swallowing function.
- 3- Nurses at surgical unit should master Shaker Exercises and administer it properly with their patients who have swallowing difficulty to improve swallowing and eating ability.

#### NURSING IMPLICATION OF THE STUDY

It was found that Shaker Exercises was easily to train the patients on; as it is priceless and at the same time it improves their swallowing function beside the medical treatment.

#### ACKNOWLEDGMENT

The researchers would like to express their sincere gratitude to all patients participate in the current study for cooperation throughout the study period. The researchers would like also to express their deepest gratitude and appreciation to all surgeon and nurses at surgical departments at a selected University Hospital, Egypt for their cooperation and effort to facilitate data collection process and all the progression to fulfill this study.

#### REFERENCES

- [1]. Dejong J (2016). Is the Shaker exercise effective in rehabilitating swallowing function in individuals with dysphagia due to upper esophageal dysfunction? Critical Review. University of Western Ontario: School of Communication Sciences and Disorders [https://www.uwo.ca/fhs/lwm/teaching/EBP/2015\\_16/DeJong.pdf](https://www.uwo.ca/fhs/lwm/teaching/EBP/2015_16/DeJong.pdf)
- [2]. Mishra, Rajappa, Tipton, &Malandraki (2015). The reclineexercise: Comparisons with the head-life exercise in healthy adults. *Dysphagia*, 30, 730-737.
- [3]. American Thyroid Association (2018).Hyperthyroidism. Available at: [www.Thyroid.org](http://www.Thyroid.org).
- [4]. Ross,D.S, Burch,H.B., Cooper,D.S. , Greenlee ,M.C., Laurberg ,P., Maia,A.L., Rivkees, S.A., Samuels,M., Sosa,J.A., Stan,M.N.&Walter,M.A. ( 2016).American Thyroid Association Guidelinesfor Diagnosis and Management of Hyperthyroidismand Other Causes of Thyrotoxicosis. American Thyroid Association;26(10). Inc. DOI: 10.1089/thy.2016.0229.
- [5]. Pernambuco,L., Silva,M.P., Almeida,M.N.Morais Costa, E.B.& Souza,L.B.(2017) Self-perception of swallowing by patients with benign nonsurgical thyroid disease. *CoDAS* ;29 On line version ISSN 2317-1782.
- [6]. Banday, T.H., Bhat, S.B., Kmat, A., Bhat, S. &Nanjundswamy, M.(2014). Thyrotoxicosis with primary presentation as dysphagia: a rare manifestation. *International Journal of Research in Medical Sciences*; 2(3):1188-1190.
- [7]. Jansson-Knodell, C.L., Codipilly, C.&Leggett, C.L. (2017).Making Dysphagia Easier to Swallow: A Review for the Practicing Clinician *Mayo Foundation for Medical Education and Research*;92(6):965-972.
- [8]. Lalsa S P. (2017). Dysphagia: Approach to Assessment and Treatment. *Journal of Head Neck & Spine Surgery*; 1 (1). ISSN: 2577-2864 .DOI: 10.19080/JHNSS.2017.01.555555.
- [9]. Fass R. (2017).Overview of dysphagia in adults Available at: [www.uptodate.com](http://www.uptodate.com).
- [10]. Clark K. (2015).Dysphagia, dyspepsia, and hiccup.Textbook of Palliative Medicine. (5th edition). Oxford University Press.1-1].
- [11]. Voigt, A.P. (2014). Knowledge of Nurses Regarding Dysphagia in patients with Stroke in Namibia.A thesis for Master's degree of Science inPhysiotherapy, Faculty of Community and Health Sciences, Department of Physiotherapy,University of the Western Cape.
- [12]. Kraaijenga, S.A., Molen, L.V. Stuijver,M.M., Takes, R.P., Al-Mamgani, A. Brekel, M.M. &Hilgers, F.J. (2017).Efficacy of a novel swallowing exercise program for chronic dysphagia in long-term head and neck cancer survivors. *Head & neck*. (39)3. Available at <https://www.researchgate.net/publication/318864935>
- [13]. Babu, H.S. Balasubramaniam, R.K. & Varghese, A. (2017). Effect of Modified Shaker Exercise on the Amplitude and Duration of Swallowing Sounds: Evidence from Cervical Auscultation .*Rehabilitation Research and Practice*. Article ID 6526214. <https://doi.org/10.1155/2017/6526214>.
- [14]. Park,J. S., Hwang ,N.K., Oh, D.H. & Chang, M. Y.( 2017). Effect of head lift exercise on kinematic motion of the hyolaryngeal complex and aspiration in patients with dysphagic stroke.*Journal of oral rehabilitation*; 44(5).Pages 385-391
- [15]. Kim, K.D., Lee, H.J., Lee, M.H., &Ryu, H.J. (2015). Effects of neck exercises on swallowing function of patients with stroke. *Journal of Physical Therapy Sciences*, 27,1005-1008.
- [16]. Langmore, S.E. &Pisegna, J.M.(2015).Efficacy of exercises to rehabilitate dysphagia: A critique of the literature. *International Journal of Speech-Language Pathology*.1–8. ISSN 1754-9507 print/ISSN 1754-9515 online .Pathology

- Association of Australia Limited Published by Informa UK, Ltd. DOI: 10.3109/17549507.2015.1024171.
- [17]. Jones, C. A., Knigge, M. A., & McCulloch, T. M. (2014). Speech pathologist practice patterns for evaluation and management of suspected\_cricopharyngeal dysfunction. *Dysphagia*; 29,332-339.
- [18]. Wayne G. (2014). Ida Jean Orlando's Deliberative Nursing Process Theory. <https://nurseslabs.com/ida-jean-orlandos-deliberative-nursing-process-theory/>
- [19]. Rani,J.S., Porkodi, A.&Seethalakshmi, A. (2013).Effectiveness of Dysphagia Exercises on Swallowing Ability Among Patients with CVA . *Journal of Science' 3(2)*.76-81.
- [20]. Al Shahrani A. S., El Metwally A., Al Surimi K., Bin Salih S., Saleh Y., Al Shehri A. and Ali A., (2016). The epidemiology of thyroid diseases in the Arab world: A systematic review. *Journal of Public Health and Epidimiology*. Vol. 8(2), pp. 17-26, February 2016.
- [21]. American Thyroid Association <https://www.thyroid.org/world-thyroid-day-2017>
- [22]. Paul C. Price, Rajiv Jhangiani, Chiang C. A., Leighton D. C., & Cuttler C.. (2017). *Non-Equivalent Groups Designs. Research Methods in Psychology*. 3rd American Edition. PRESSBOOKS.
- [23]. Manor Y and Cohen G. (2011). Swallowing Disturbance Questionnaire for Detecting Dysphagia The American Laryngological, Rhinological and Otological Society. DOI: 10.1002/lary.21839. pp 1383-1387.
- [24]. Shaker, R., Easterling, C., Kern, M., Nitschke, T., Massey, B., Daniels, S., Dikeman, K. (2002). Rehabilitation of swallowing by exercise in tube-fed patients with pharyngeal dysphagia secondary to abnormal UES opening.*Gastroenterology*, 122, 1314-1321
- [25]. Nordqvist C. (2017). What's to know about hyperthyroidism. University of Illinois-Chicago, School of Medicine. <https://www.medicalnewstoday.com/articles/9153.php>
- [26]. Dowshen S. (2015). Thyroid Disease. <https://kidshealth.org/en/teens/thyroid.html>
- [27]. Samuels M. H. (2018). Hyperthyroidism in Aging. <https://www.ncbi.nlm.nih.gov/books/NBK278986/>
- [28]. Myo Clinic Staff (2019). Hyperthyroidism (overactive thyroid). <https://www.mayoclinic.org/diseases-conditions/hyperthyroidism/diagnosis-treatment/drc-20373665>
- [29]. Schwarz C., Leichte A. B., Arampatzis B. and Feidler G. M. (2012). Thyroid function and serum electrolytes: Does an association really exist? *Schweizerische medizinische Wochenschrift*. DOI: 10.4414/smw.2012.13669
- [30]. Mepani R, Antonik S, Massey B, Kern M, Logemann J, Pauloski B, Rademaker A, Easterling C and Shaker R (2009). Augmentation of deglutitive thyrohyoid muscle shortening by the Shaker Exercise. *HHS Public Access*. ;24(1):26-31. doi: 10.1007/s00455-008-9167-y.
- [31]. Logemann J. A., Rademaker A., Pauloski B. R., Kelly A., Stangl-McBreen C., Antinoja J., Grande B., Farquharson J., Kern M., Easterling C. and Shaker R. (2009). A Randomized Study Comparing the Shaker Exercise with Traditional Therapy: A Preliminary Study. *HHS. Public Access*. doi: 10.1007/s00455-009-9217-0
- [32]. Suman Z, Manzoor T. Azmat R., Ibrahim M. and Tahira S. (2015) effectiveness of swallowing exercises in dysphagia: a speech-pathologist perspective. <https://www.researchgate.net/publication/301764706>