Isokinetic characteristics and EMG activity Of some working lower limb muscles on Performance of ankle joint for free and fin swimmer

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Introduction and research problem:

Scientific progress in athletic training field, fighting to beat record in different sports competition in general and specially in swimming is not accidentally or fortuitously, but it depend on scientific basis and scientific research methods and modern technological scientific devices to identify best ways and scientific theories to develop athletic training field with regard to different factors related to activity nature, also it need concentration on different physical, technical and motor factors for player to achieve a performance level make them able to beat records and reach the world levels in swimming, developing technical performance depend on existence of many modern devices and tools needed by the swimmers during execution of exercises to develop technical performance level which have an effective impact in increasing speed and adjusting rhythm of leg and arm movement.

There is a numerous isokinetic training ways that resemble technical performance of swimming as it depend on training specific principal which mean using movement resemble technical performance of activity from the dynamic construction, also depend on muscle overloading which have an effective impact in producing maximum energy during movement, "Ehab Ismail" (2008) mentioned that isokinetic exercises combine work of nervous and muscular system (5).

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"Abo El Ela Abd El Fatah" (2003) (2011) mentioned that these kind of exercises that similar to the activity movements considered the newest type of resistance program that lead to improving muscular performance to a great extent as it work on producing maxium strength on the same performance path, generating strength through movement in a defined time or through constant speed, by this a large number of motor units share in performance, and it depend also on using movements similar to that performed during swimming and organize resistance types, we can summarized the advantages of this kind of training by using muscular groups that work in the main activity, save the time as a result of concentrating on muscles, reduce the need of using special strength training for swimming by using the same performance in swimming (238) (142).

Monofin swimming is characterized by a simple coordinating movement and have an effective style as it help the swimmer to be able to remove a quantity of water more than the double fin swimming and face spin less than that faced by double fin swimmer, the swimmer perform a wavey movement and the minimum range of increasing these waves is the leg movement, using fins help in increasing leg speed, adjusting rhythm between arm movements and leg stroke and increase ankle joint flexibility (13: 25) (5)

Due to continuity of demands to understand details of muscular activity and deficiency in traditional ways to realize factes about this work, measuring of muscular activity technique has appear and known as *"Electromyography" as Abou El Ela Abd El Fatah & Sobhi Hassanin (1997) confirm importance of EMG activity pattern as we depend on it in recording the relation between work of nervous & muscular system

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* Device record electrical characteristic by surface or deep electrodes measuring effort difference between two points, enlarge and record related to time (16 : 18)

through recording electrical changes accompany contraction, this style has contribute in developing Science of sport physiology in two main ways which is neural & mascular physiology as a way to analyze electrical phenomenon and motor performance physiology that consider more linked to mechanics (1: 198 – 199).

So the researcher has seen that technological transformation from 'Analog system" to "Digital system" in dealing with scientific devices data lead to a great progress in kind of program used to deal with data of this devices, as through these programmes it has been able to realize many complex variables that can be easily recorded and many scientific theories have rise that explain the enormous quantity of data given by this system due to role of isokinetic and EMG device in providing a large and important quantity of data the given by the program of these two devices, and its practical value in athletic training generally and specially in swimming, accuracy of data recording to explain physical swimming performance, give us an opportunity to explain muscular contractions and motor performance, setting different and appropriate training programs to develop training process, initiate a new regions for laboratory researches.

Therefore the research problem take place as it is a trial to connect between results of isokinetic device EMG pattern for some lower limb muscles working in ankle joint, and comparing these results between free and fin swimmer to recognize the most important differences between them, which may have an effective impact on identifying detailed description about joint performance and working muscles through out put results from devices used in measuring, which may contribute in explaining nature of physical performance and developing different training methods for swimmers.

Research objectives:

1- Identifying some isokinetic characteristics of ankle joint performance (right and left) for free and fins swimmers.
2- Identifying properties of some variables related to EMG activity for some lower limb working muscles on performance of ankle joint (right and left) for free and fins swimmers.

Research Assumptions:

1- Is there any difference in isokinetic characteristics of ankle joint performance (right and left) for free and fin swimmers
2- Is there any difference in properties of some variable related to EMG activity for some lower limb working muscles on performance of ankle joint (right and left) for free and fin swimmers.

Research clue :

1- Average work.
2- Total work .
3- Average power.
4- Range of motion .
5- Median frequency (MF).
6- Mean power frequency (MPF).
7- Average EMG (AEMG).
8- Total area.
9- Work / loading.
10- Measuring unit (Micro volt) (UVS).

*** Research procedure:**

*** Research Method:**

The researcher used the descriptive design as it is appropriate for nature of the research.

*** Research sample:**

The sample was chosen intentionally, one free junior swimmer acquire regional championship, one fin junior swimmer acquire. African championship (under 13 year), in choosing the swimmers the researcher take into account that they are in a higher training (state) ready to an external international championship, the measurement was applied three days before traveling.

<u>* Research steps:</u>

The experiment procedures was applied in specific unit laboratory in faculty of physical education for boys (El Harm) during 2-3/6/2015 for measurement of isokinetic and EMG activity device for muscles

*** Tools and device experiment:**

The researcher has prepared the experiment place devices and tests execution as follows.

*** A : isokinetic device[*] :**

The researcher used the isokinetic device to measure endurance of working muscles, joints range of motion and generation of resistance for the swimmer.

The researcher was supported by the director of the device to adjust the program, specify the device protocol and placing the special unit for joint ankle measurement movement and fixing it in the right place and operating the device program to perform five consecutive attempts, extension and flexion for foot joint (right-left) apart from the other, some points was taken into consideration on performing the isokinetic test :

[*] This device used to measure and evaluate quantity of muscle endurance and joint range of motion and generating a resistance equal to player performance strength (9 : 295)

- Insert the data for every player apart from the other player for weight, height and age.
- Warming up before test performance to guarantee the efficiency of muscle performance resulting from blood flowing in the muscles increasing the internal temp and protecting from injury.
- Fixing the automatic resistance of the device.
- The player lay on his back on the device bench and adjust it according to the player height, the knee is fully extended and fasten the trunk thigh and ankle joint
- To prevent participation of muscle in the ankle joint test.
- Fixing resistance and speed automatically (mean increasing resistance automatically).
- The range of motion was fixed on 60° degree for ankle joint before applying the test to prevent injury.
- Selecting the appropriate angle of speed used in the measurement process as there is an angle of speed for every joint.
- Train the player on the device and give him information about the test to be adapted with the device which help in getting best results and insure accuracy and objectivity of the test.
- Select the appropriate program and set the trials numbers, so every player perform the trials of planter flexion and dorsi flexion for ankle joint in range of motion 60° degree the performance must be with a max power and speed and continuously .
- Performance, information and verbal encouragement must be the same for the two player during test performance.
- Print the result in a report show the average of the five trials for ankle joint.

Some variables related to isokinetic device:

- Average power (joule)
- Average work (joule)
- Total mechanical work (joule)
- Range of motion (degree)

***B- EMG device**

The researcher used wireless EMG system that have high input rate for electric activity data that can be seen and saved at the same time. It consist of (8) channel to record the activity of (8) muscle in the same time as every channel work alone in the program and have special handling procedures. The EMG data is recorded by external electrodes put on the surface of the skin and above the muscle and on the place specified by the program of recording EMG during performance.

The device was adjusted to have some information's and data about ability of muscles to get out max power during work and related to the measured muscles in the research that are:

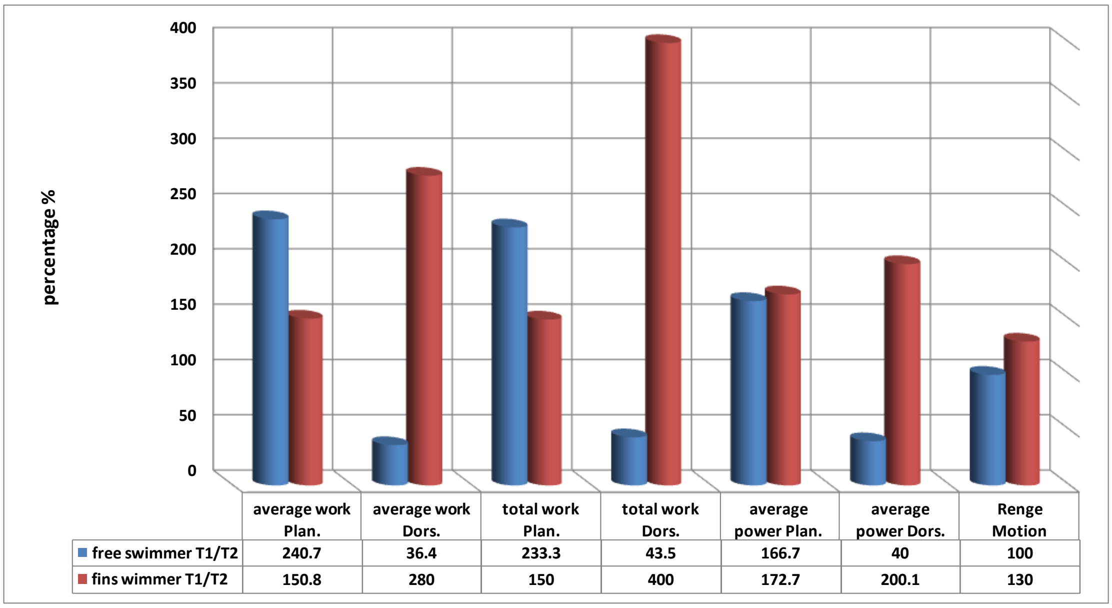
- Median Frequency (MF) (HZ)
- Mean power frequency (MPF) (HZ)
- Average EMG (AEMG) (HZ)
- Work/ Loading (UVS)
- Total area (UVS)

The researcher fix the electrodes with the possibility of movement by using transmitter in a range of 500 m. These electrodes connected to the transmitter by a triple cable. The player control operating of the transmitter immediately before the measurement . The device was adjusted to work at the same time with the isokinetic device. The working muscles in the lower limb for the right & left sides have been selected so the device record their electric activity:

- CH_1 : Rectus femoris
- CH_2 : Vastus lateralis Muscle
- CH_3 : Vastus Medialis muscle
- CH_4 : Semitendinosus Muscle
- CH_5 : Biceps femoris muscle
- CH_6: Gastrocnemius muscle – Lateral part
- CH_7 : Tibials Anterior muscle
- CH_8: Gastrocnemius muscle – medial part

Result review and Discussion :

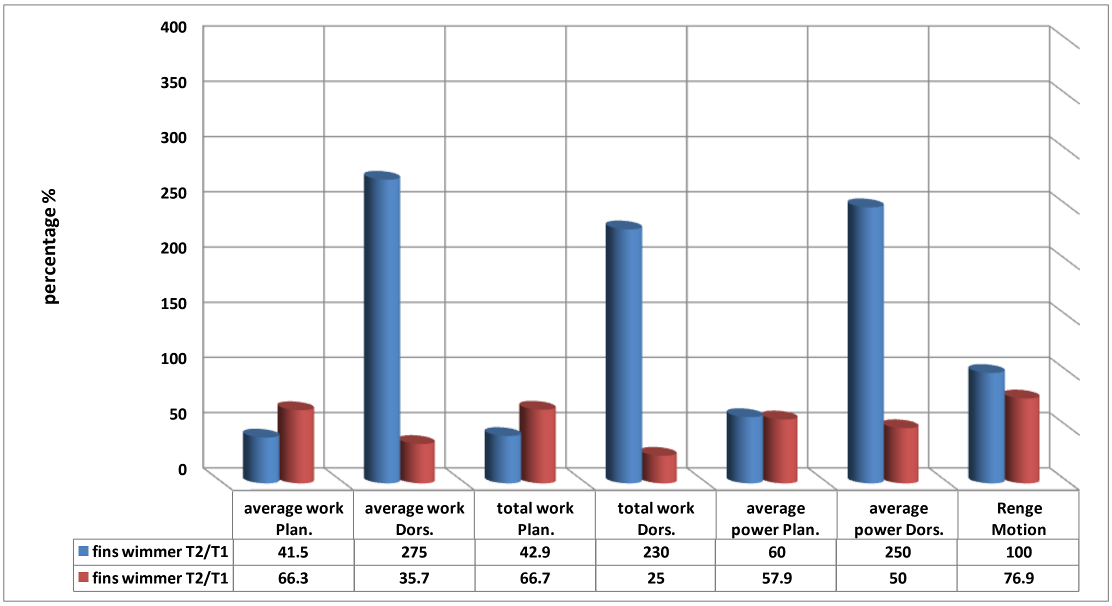
First : Isokinetic measurement results



	average work Plan.	average work Dors.	total work Plan.	total work Dors.	average power Plan.	average power Dors.	Renge Motion
free swimmer T1/T2	240.7	36.4	233.3	43.5	166.7	40	100
fins wimmer T1/T2	150.8	280	150	400	172.7	200.1	130

Figure (1)

Percentage ratio of some isokinetic variables planter flexion and dorsi flexion for performance of left side ankle joint with respect to right side (T_1/T_2) for free and fin swimmers



	average work Plan.	average work Dors.	total work Plan.	total work Dors.	average power Plan.	average power Dors.	Renge Motion
fins wimmer T2/T1	41.5	275	42.9	230	60	250	100
fins wimmer T2/T1	66.3	35.7	66.7	25	57.9	50	76.9

Figure (2)

Percentage ratio of some isokinetic variables planter flexion and dorsi flexion for performance of left side anklei joint with respect to right side (T_2/T_1) for free and fin swimmers

Figure (1), (2) show the percentage of some sample variables during measurement on isokinetic device for free and fin swimmers

- Average work
- Total work
- Average power
- Range of motion

From reviewing results of isokinetic variables percentage of free and fin swimmers planter flexion and Dorsi flexion for performance of ankle of left side with respect to right side (T_1/T_2) and for right side with respect to left side (T_2/T_1) we realize.

1. Increase in percentage of extension average work, total extension mechanical work, flexion average work, extension average work, range of motion for ankle performance in the left side with respect to right side (T_1/T_2) for fin swimmer higher than free swimmer.

2. Increase in percentage of extension average work, total extension mechanical work for ankle performance in the left side with respect to right side (T_1/T_2) for free swimmer higher than fin swimmer.
3. Increase in percentage of extension work, total extension mechanical work, extension average power, flexion average power, range of motion in performance of ankle in left side with respect to right side (T_2/T_1) for free swimmer higher than fin swimmer .
4. Increase in percentage of flexion average work, total flexion mechanical work in performance of ankle in left side with respect to right side (T_2/T_1) for fin swimmer higher than free swimmer.

From the researcher point of view this result for planter flexion and Dorsi flexion for performance of left side ankle with respect to right side (T_1/T_2) specified to fin swimmer is higher than free swimmer in most variables as he depend on extension average work, flexion and extension average power, so the fin swimmer can pull the fin weight which contribute in range of motion for ankle joint with 130% percent with respect to free swimmer with 100% percent, he need a very small amount of other variables to contribute in endurance of working muscles, joint range of motion and producing a resistance equal to strength of player performance .

From the researcher point of view this means that quantity of working muscles power endurance, joints range of motion and producing resistance equal to performance strength of the player inside water for planter flexion and dorsi flexion to complete performance of ankle joint which permit floating process and doesn't disturb the horizontal position and participation of muscular work in a way permit coping with different resistance for free and fin swimmer.

Maram El Hosban study (2009) (11) has proved that the length of the fin represent a compressive power on the ankle joint as it need working of neuro reflective actions for this joint to prevent injury.

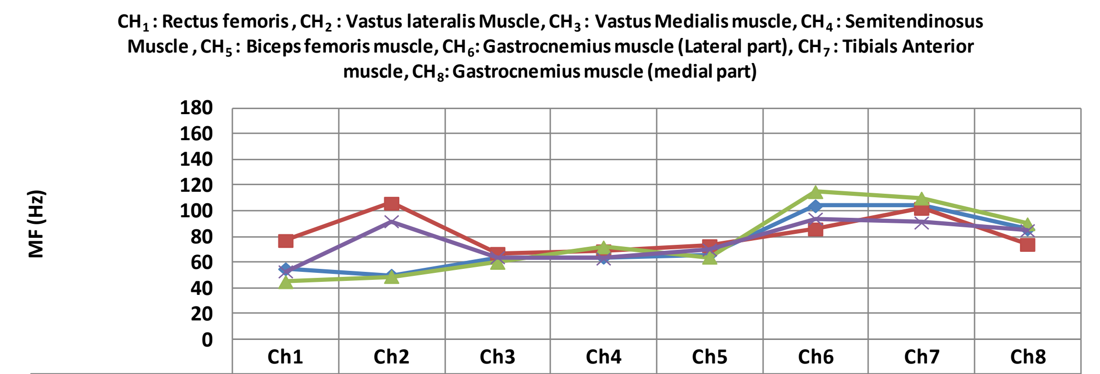
Hesham El Shagir (2003) deduce that on hitting by the fin this must be in a small depth so as not to cause sinking of the lower limbs and its movement will have weak range and high frequency (13:33)

Both Khairia El Sokkari and Mohamed Beriea (1999) Mohamed Beriea and Ehab El bdiwy (2007) agree that floating produce a natural external power in opposition to gravity which allow the body and its extremity reach full range of motion appropriate for the joint and doesn't disturb horizontal position inside water which help in decreasing the compressive power or weight on all joints that have an important role in developing flexibility (7: 11) (10: 16).

Both Osama Ratab and Mohamed Ali Zaki (1998), Abo El Ela and Hazem Hussien (2012) agree that increasing of ankle joint range of motion help in increasing swimmer speed, producing maximum power with full range of ankle motion so we have to depend on power evaluation results by isokinetic device as it have a high accuracy degree as it can be recorded in any movement stage. This lead to identifying the maximum power in addition to realize the way of using the swimmer to his power during different stages of movement as it resemble the muscular work (4 : 157,198) (3 : 142).

From the mechanical point of view Susan (2012) show that in case of foot joint working in a full range of motion without using fins it is executed with a fixed rotational speed but in case of using fins the swimmer try to perform this movement in a full range of motion and by the same speed rate as there is a mechanical relation between angular speed rotational and the peripheral speed (linear) (22 : 363)

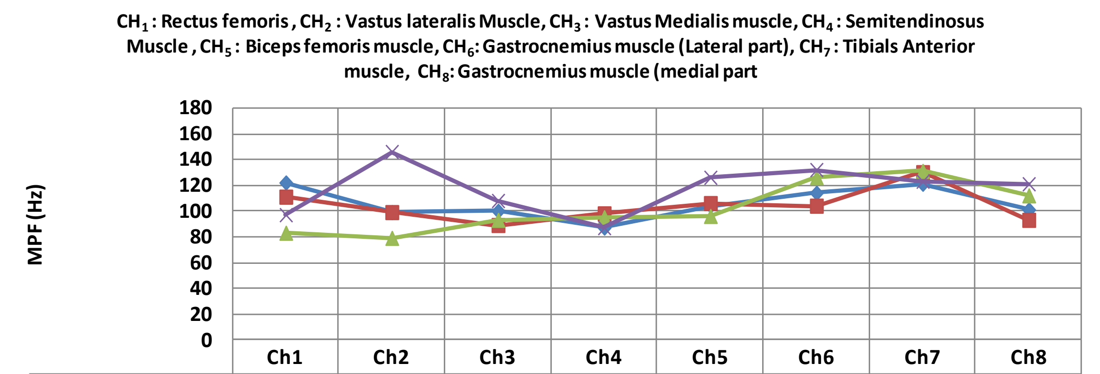
Second: EMG measurement for some muscles in lower limbs (right and left)



	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8
R Free swimmer	55	50	64	64	66	104	104	86
R Fin swimmer	77	106	67	69	73	86	102	74
L Free swimmer	45	49	60	72	64	115	110	90
L Fin swimmer	53	92	64	63	70	94	91	85

Figure (3)

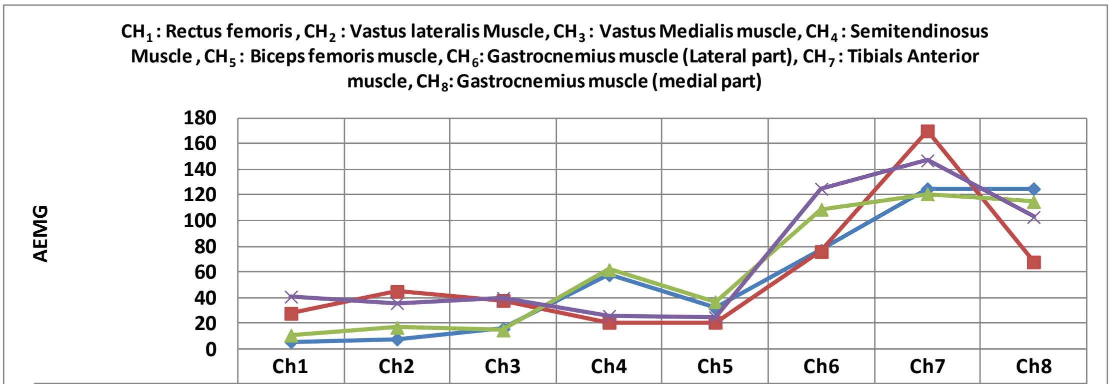
EMG activity of median frequency (MG) for some lower limb muscles (right and left) participated in isokinetic performance of ankle joint for free and fin swimmer



	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8
R Free swimmer	122	99	100	87	104	114	121	101
R Fin swimmer	111	99	89	98	106	104	130	93
L Free swimmer	83	79	93	95	96	126	131	112
L Fin swimmer	97	146	108	87	126	132	123	121

Figure (4)

EMG activity of median frequency (MPF) for some lower limb muscles (right and left) participated in isokinetic performance of ankle joint for free and fin swimmer



	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8
R Free swimmer	6	8	16	58	32	77	125	125
R Fin swimmer	28	45	38	21	21	76	170	68
L Free swimmer	11	17	15	62	37	109	121	115
L Fin swimmer	41	36	40	26	25	125	147	103

Figure (5)

EMG activity for average EMG (AEMG) for some lower limbs muscles (right and left) participated in isokinetic performance of ankle joint for free and fin swimmer

Figure (3), (4), (5) show the sample characteristic during EMG measurement for eight muscles in the lower extremity. The results show the variation in median frequency (MF), mean power frequency (MPF), Average EMG (AEMG) between the muscles participated in the isokinetic performance for planter flexion and Dorsi flexion of left and right ankle joint for free and fin swimmer.

Results of figure (3) show that EMG measurement for median Frequency (MF) for some lower limb muscles (Right and left) that share during isokinetic performance of ankle joint for free and fin swimmer in EMG value of median frequency (MF):

1. 1-Value of EMG for muscles (Vastus medialis muscle CH_3, Semitendinosus muscle CH_4, Biceps femoris muscle CH_5) is close to each other for free and fin swimmer in both right and lower limb, the reason for this may be due to similarity in nature of performance as the technique is the same, Susan (2012) consider that the main work for these muscles as a prim-movers to flexion of knee joint.

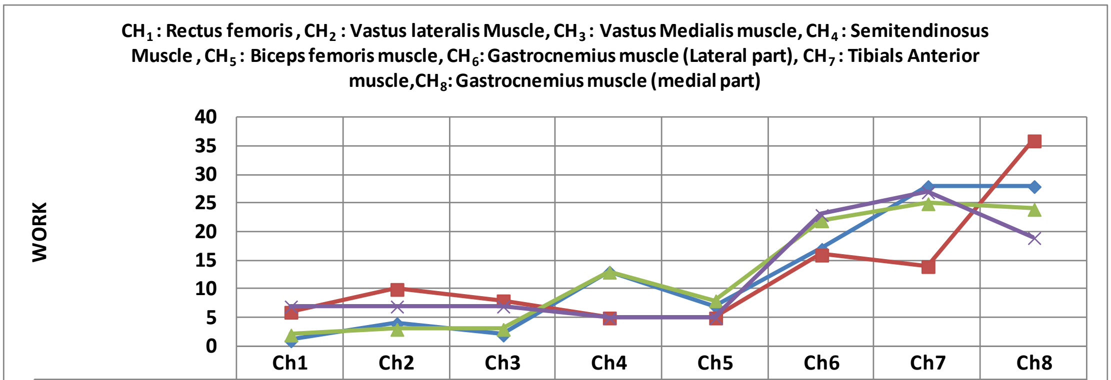
2. The Vastus lateralis muscle CH_2 has recorded the highest median frequency (MG) in behalf to fin swimmer when compared to free swimmer for both right and left limb. The researcher said that this result because this muscle share with a high percent in stability of knee joint angle, susan (2012) indicate that this muscle is a supporter muscle in flexion and fixing movement of thigh externally or rotation of thigh internally. (22 : 193).
3. As for the "Rectus Femris" CH_1 it recorded increase in the muscular activity for fin swimmer this may be due to its importance in knee joint extension, this was identified in Anderson (2012) Alkner (2000) Studies that there is correlation and linear relation for "Vastus medialis muscles"CH_3, 'Biceps femoris muscle", CH_5"Rectus Femoris"CH_1 between EMG and muscles strength in general and there is a correlation between EMG measurements with contraction speed and speed of leg movement (14) (15).
4. The value of medin frequency (MG) is dose to each other in (Gastrocnemius muscle – lateral part CH_6, Tibials anterior muscle CH_7, Gastrocnemium muscle – medial part CH_8) but with a higher EMG for free and fin swimmer, the researcher signify that this is due to responsibility of these muscles for " planter flexion" and " Dorsi flexion", also for Keeping metatarsus in its natural path to prevent its movement in another position to increase the resistance falling on the ankle joint for free and fin swimmer , kim (2015) study identify that, there is a difference between two groups in the muscular activity for the group that used the isokinetic exercises and in behalf to post – measurement for "Tibial anterior muscle" CH_7(17).

Results from figure (4) show that measurement of mean power frequency (MPF) value doesn't differ too much between free and fin swimmer this indicate the continuity of muscular fibers stimulation for both limbs (left and right side), increase in charging of nervous system to muscular fibers, also the increase of EMG and muscular power is due to sending many neural signals to stimulate a great number from muscular fibers, increasing number of dynamic units that participate in the performance and increasing working synchronization of motor neural cells that participate in muscular contraction (2: 197) (12)

Measurement results in figure (5) for average EMG (AEMG) show variations in measuring value between free swimmer and fin swimmer in muscles of both limbs (right and left side) that share in isokinetic performance. Muscles of (Rectus Femoris,CH_1 vastus lateralis muscle, CH_2 vastus Medialis muscle) CH_3 was higher in average EMG (AEMG) for fin swimmer when compared by free swimmer. This was mentioned by studies of "Anderson" (2012) "AlKner" (2000) as the value is close to each other in the EMG activity of "Biceps Femoris muscle",CH_5 and record higher EMG activity and reconcile of average value for both of them in muscles of (Gastrocnemius muscle – lateral part, CH_6 Tibials anterior muscle, Gastrocnemius muscle medial part)CH_8 (14) (15)

Study of 'palmer' (2015) , "Kim" (2015) mentioned that fin swimmer characterized by a higher EMG for both right and left side in "Tibials anterior muscle"CH_2 and in "Semitendinusus muscle".CH_4 (20) (17)

Abo El Ela & Hazem Hussien (2011) signify the importance of fins in developing strength and improving the co- ordination ability of the swimmer (3 : 90)



	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8
R Free swimmer	1	4	2	13	7	17	28	28
R Fin swimmer	6	10	8	5	5	16	14	36
L Free swimmer	2	3	3	13	8	22	25	24
L Fin swimmer	7	7	7	5	5	23	27	19

Figure (6)

EMG of work/Loading (UVS) for some lower limb muscles (right and left) participated in isokinetic performance of ankle joint for free and fin swimmer

Figure (6) show the research sample characteristic during EMG measurement of eight muscle in the lower limb, the results show an obvious variations in work / Loading (UVS) between the muscle participated in the isokinetic performance of ankle joint (right and left) for free and fin swimmer.

Figure (6) explain results of EMG measurement for percentage rate of working / load of muscles as the percentage total for right and left limb was as follows:

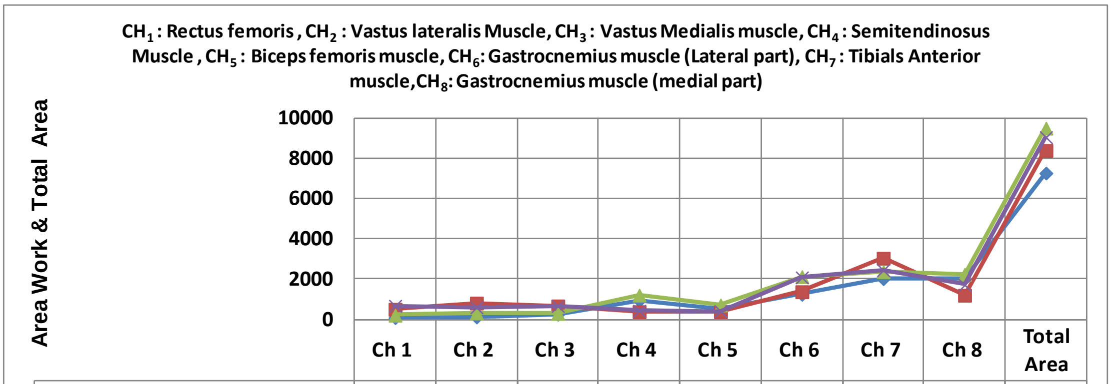
- Rectus Femoris Ch_1 : Free swimmer 3% , fin swimmer 13%
- Vastus lateralis muscle Ch_2 : Free swimmer 7%, fin swimmer 17%
- Vastus medialis muscle Ch_3 : Free swimmer 5%, fin swimmer 15%.
- Semitendinosus muscle Ch_4: free swimmer 26% fin swimmer 15%
- Biceps femoris muscle Ch_5: free swimmer 15% fin swimmer 10%
- Gastrocnemius muscle – Lateral part Ch_6 : free swimmer 39%, fin swimmer 39%
- Tibials anterior muscle Ch_7: free swimmer 53% fin swimmer 41%

- Gastrocnemius muscle – medial part Ch_8 : free swimmer 52%, fin swimmer 55%

Results show closeness in total of work/load (UVS) for right and left muscles for free swimmer by this order (Rectus Femoris muscle, CH_1 vastus lateralis muscle, CH_2 vastus medials muscle) CH_3 by a 5% participation average, increase in work / Load in (Biceps femoris muscle, CH_5 semitendinosus muscle CH_4, by 13.7% participation average and record higher percentage in (Gastrocnemius muscle – lateral part, CH_6Gastrocnemius muscle medial part, CH_7 Tibials anterior muscle CH_8) by 48% participation average.

As for fin swimmer closeness in total of work/load (UVS) for right and left side muscles by this order (Semitendinosus muscle CH_4 Biceps femoris muscle CH_5, Rectus femoris muscle CH_4, vastus medialis muscle CH_3, vastus lateralis muscle) CH_2 by 23.3% participation average and record higher percentage in (Gastrocnemius muscle- lateral part, CH_6 Tibials anterior muscle, CH_7 Gastrocnemius muscle – medial part CH_8) by 45% participation average.

The researcher realize that work / load (UVS) for both right and left muscles in (Gastrocnemius muscle – lateral part CH_6, Gastrocnemius muscle- medial part CH_8, Tibials anterior muscle) CH_6 work with the same work/load (UVS) for free and fin swimmer in muscular performance this is due to importance of these muscles in affecting ankle joint and resemblance in performance nature .



	Ch 1	Ch 2	Ch 3	Ch 4	Ch 5	Ch 6	Ch 7	Ch 8	Total Area
Area Work (R) Free swimmer	92	124	262	949	527	1248	2024	2040	7267
Area Work (R) Fin swimmer	505	814	673	387	386	1378	3041	1204	8390
Area Work (L) Free swimmer	210	324	297	1207	716	2127	2371	2242	9495
Area Work (L) Fin swimmer	677	600	673	432	412	2087	2449	1718	9048

Figure (7)

EMG measurement of area work for Lower limb muscles (right and left) participated in isokinetic performance of ankle joint for free and fin swimmer

Figure (7) show the research sample characteristics during EMG measurement for eight lower limb muscle. The result show an obvious variation in total area work between muscles participated in isokinetic performance of right and left ankle joint for free and fin swimmer.

Figure (7) show measurement of area work for working muscles during isokinetic performance of right and left ankle joint for free and fin swimmer and their a closness in value of (Rectus femoris muscle, vastus lateralis muscle CH_2, vastus medialis muscle CH_3, semitendinosus muscle, CH_4 Biceps femoris muscle) CH_5 increase in work of (Gastrocnemius muscle lateral part, CH_6 Gastrocnemius muscle – medial part, CH_8 Tibials anterior muscle) CH_7 and this was mentioned in "Anderson" (2012), "Alkner" (2000), "plamer" (2015), "Kim" (2015) studies (14) (15) (17) (20).

The total area work for participating muscles in isokinetic performance of left and right ankle joint for free and fin swimmer, the free swimmer recorded (16762) and increase for fin swimmer (17438), this reducing in free swimmer may be due to technique of execution which is tilting during breathing, results of isokinetic and EMG measurement show that this may be the reason and that using fins is an effective factor in preventing this rotation and water resistance. " Abo El Ela" and "Hazem Hussien" (2011) has mentioned that ideal performance of leg guarantee maintance of proper body position which affect pull efficiency (3 : 58).

"Dina metwalli" (2004) mention that using fins help in increasing improvement percentage of flexibility and leg muscular power for junior swimmer and as a result the record level will improve (8).

Miura Et Al (2000) confirm that increasing of total area work increase muscle EMG which lead to muscle tension that affect the performance (18).

The researcher realize a great importance for this physiological laboratory tests by EMG activity and isokinetic activity for muscle, and must applied regulary as we can know through these tests the injury risk.

Conclusion :

* Conlcusions related to isokinetic measurements for free and fin swimmer.

1. 1-Increase in percentage of extension average work, extension work, flexion average power, extension average work, range of motion for left side of ankle joint performance in attribute to right side (T_1/T_2) higher only for free swimmer than fin swimmer, also there is an increase in the same rate for left side of ankle joint in attribute to right side (T_2/T_1) for free swimmer higher than fin swimmer.
2. Increase in percentage of flexion average work, flexion total work for left side of ankle joint in attribute to right side (T_1/T_2) for free swimmer higher than fin swimmer, also there is an increase in rate of left side performance for ankle joint in attribute to right side (T_2/T_1) for fin swimmer higher than free swimmer.

3. Quantity of working muscles endurance, joints range of motion, producing resistance equal to power of player performance inside water for planter flexion and Dorsi flexion to perform a complete motion for ankle joint which allow floating and doesn't disturb the horizontal position and participation of muscular work in a way allow overcoming different resistance for free and fin swimmer.

* Conclusions related to EMG measurements for free and fin swimmer.

1. There is a variation and closeness in EMG measurement for median frequency (MF) of some lower limb muscles (right and left) that participated in isokinetic performance of ankle joint for free and fin swimmer as follows:
   - Closeness in EMG value for (vastus medialis muscle CH_3, semitendinosus muscle CH_4, Biceps Femoris muscle CH_5) for both free and fin swimmer .
   - Vastus lateralis muscle CH_2 higher median frequency (MF) inbehalf to fin swimmer compared by free swimmer
   - Rectus femoris CH_1 record increase in muscular activity for fin swimmer.
   - There is a closeness in median frequency (MF) value in (Gastrocnemius muscle – lateral part CH_6, Tibials anterior muscle CH_7, Gastrocnemius muscle medial part CH_8) but with a higher EMG for free and fin swimmer.

2- Measurement of mean power frequency (MPF) value doesn't have a great difference between free and fin swimmer, this signify continuity of muscular fibers stimulation for both limbs (right and left side) and increase in stimulation of nervous system to muscular fibers .

3- Variation in Average EMG value (AEMG) measured for free and fin swimmer in the muscles of both limbs (right and left side) participated in isokinetic performance muscle of rectus femoris, vastus lateralis, vastus medial) was higher in average EMG (AEMG) value for fin swimmer compared to free swimmer.

4- Contribution percentage of work for left and right muscles in (Gastrocnemius muscle – lateral part, Gastrocnemius muscle – medial part, Tibials anterior muscle) work with same muscular work contribution percentage for free and fin swimmer this due to importance of these muscles in affecting ankle joint and similarity in performance nature.
5- Measurement of total area work for working muscles during isokinetic performance of left and right ankle joint for free and fin swimmer show closeness in value of (Rectus Femoris muscle, vastus lateralis muscle, vastus medialis muscle, semitendinosus muscle, Biceps femoris muscle) and increase in exerted work in (Gastorcnemius muscle – lateral part, Gastrocnemius muscle – medial part, Tibials anterior muscle)
6- Total area for exerted work in participated muscles during isokinetic performance of right and left ankle joint for free and fin swimmer, free swimmer record (16762) and increase in fin swimmer and record (17438) , this decrease for free swimmer may be due to technique performance which is tilting during breathing.

Recommendation:

Based on research result the researcher recommended the following:

1- Applying training programs by using isokinetic training inside the training units and on different age.
2- Chosing exercises that acquire muscular balance for junior between upper and lower limb and between right and left side of the body and between front and back muscular groups.

3- Analyzing the isokinetic muscular work for every part of the body, and the general and specific physical fitness required for different sport activities .
4- Give an interest to flexibility program beside strength and speed exercises to improve record level for the swimmer .
5- Importance of assessing maximum muscular work and evaluate it by using isokinetic device and EMG pattern of muscles for measurement and training regularly.
6- Using fins as an assistant modern tool to help in improving record level for juniors swimmer.
7- Importance of exercises outside and inside water for swimmers in the same motor path ways which help in improving record level for swimmers.
8- Apply studies in fin fields to identify different variables, due to rarity of studies and to affect developing training process to compete on olympic levels.

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