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Combined training programm for cladding and endurance and its conséquences on the performance of Algérian walkers

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Abstract

The purpose of this study was to show the effect of simultaneous training (of core and endurance) on the performance of Algerian walkers. We compared two groups (control group (GC) and experimental group (GT) composed of 12 practicing athletes race walking and members of the national team training under the guidelines of the same coach using only endurance training for the first group, while the second group undertook a simultaneous training of core training and 'endurance. The study lasted for a total of 08 weeks with a pre-test phase before training and a post-test phase after training. We were able to measure the VO2max, the VMA, the 05 km race walk, the core stability with the double leg lowering and the Mc Gills test. The results show that performance improved for both groups on the main endurance performance variables VO_2max, VMA and 05 km race walk), while the experimental group showed no significant improvement Compared to the control group after the various training sessions.We can conclude that simultaneous training of core and endurance has no more influence on endurance performance than training based completely on endurance.

I. Introduction

Sports training depends on different means and methods to prepare an athlete. Each method has its objectives. Mohamed Hassen Alaoui (1992, p 211 in Chennouf K et al, 2017, p 90) defines training as the different ways in which the coach can improve the athlete's physical abilities at the highest level. These means lead to adaptation and functional changes of the organs (Abu Ala 2012, p 20 and Ahmed 1998 p 20 in R.Missouri 2020). The achievement of high performance in different sports requires several years of practice. Currently, the search for sporting success attracts the majority of countries, especially developed countries (Charle P. Thiébauld et al 1997 in A. Hakoumi 2018) which have put material and financial resources in scientific research to improve the methods and rules of training for high level performances (Massicole J.P& Lassard C.1984 in Hakoumi A.2018) and Ahmed 1998 p20 in R. Missiouri 2020 p. 59). Therefore, researchers have continued to explore and search for the best training means for the development of endurance, knowing that the physiological factors that determine performance in endurance sports are the maximum consumption of oxygen VO_2max, very important factors for the achievement of high level results (A. Abdelfattah 1985 p 51-56 in Sraiya D and Majour S 2020) as well as the lactic threshold and the economy of running.

Among the methods currently used in the world of sport in general and particularly in athletic walking for the development of endurance strength is that of the sheathing method, which has been growing rapidly in recent years. Although little research has been established on the effect of this method on the performance of athletes in endurance sports, its positive effect has been proven on the reduction and prevention of injuries (Hibbs, Thompson, French, Wrigley, & Spears, 2008 ; Leetun, Ireland, Willson, Ballantyne, & Davis, 2004).

1.1 Litterarture Reviw :

The current literature offers a variety of suggestions for defining the sheathing method, i.e., stability, but it remains uncertain as to a specific conclusion. Within this framework, Kibler et al, (2016) defines the isometric or sheathing method as the ability to control the position and movement of the trunk over the pelvis to allow optimal production, transfer and control of force and movement to the terminal segment in sports activities, which is achieved by the integration of active vertebral stabilizers ; muscles, passive stabilizers that involve the spine for the performance of the athletic gesture (Tse (2005) et al, sheathing involves more muscles at the central level of the

body, of which the muscles of the trunk and pelvis that are responsible for maintaining the stability of the spine and pelvis are essential to the transfer of energy during movement. Therefore, it is theoretically believed that if the extremities are strong and the centre of mass is weak, the transmission of energy through it will result in less force production and inefficient motion (Tse, Anus, & Asters, 2005).

To maintain stability, the body must integrate sensory motor and biomechanical strategies coupled with learned responses and the ability to anticipate change. The body must therefore control the trunk in response to internal and external disturbances. Ebenbichler et al (2001) demonstrated that other muscles contract before the limb agonist when stability is stressed due to limb action. These postural adjustments allow the body to increase proximal stability and allow distal mobility.

It is believed that a sheathed body allows the athlete the complete transfer of the forces produced with the lower extremities, passing through the torso and to the upper extremities, resulting in less energy loss and therefore optimized performance. A poorly sheathed body is supposed to interrupt the transfer of energy, resulting in reduced athletic performance with the risk of injury to an underdeveloped muscle group. This assume that a better sheathing capacity in an athlete would lead to better sports performance. As a result, sheathing has become popular among coaches as a means of improving performance and reducing injuries McGill, Childs, & Liebenson(1999) Nesser & Lee (2009).

Several studies have shown a strong relationship between body stability and injury prevention.

- Zazulak et al, (2007), evaluated trunk displacement and stiffness in response to movement, as well as the ability to determine the spatial position of the trunk.

The results of the study indicated that factors related to body stability predicted knee injuries.

In contrast to the influence of sheathing on injury, few researchers have evaluated the effects of sheathing on athletic performance

- Tse et al, (2005) analysed the effectiveness of a training protocol with endurance-oriented sheathing exercises on the performance of male rowers at the university. The results showed that the program improved basic endurance, but did not improve functional performance in tests such as the vertical jump, long jump, 40m sprint. This led the researchers to state that the other variables had more influence on performance than the sheathing variable.

- Stanton, Reaburn, & Humphries, (2004) have shown that sheathing training with the Swiss ball on the economy of racing has led to the

improvement of what they have defined as baseline stability, but had no effect on physical performance measures; VO_2, VO_2max and stroke economy.
Similar results were reported in a study of the effect of training with sheathing on swimming performance. Sheathing training improved the body's ability to stabilize, but did not transfer to better swimming performance.
- Sato and mokha (2009), in contrast to these studies, revealed that a significant improvement in times over the 5000m without any change in ground reaction
Forces or leg stability was reported in à training program with sheathing that lower limb stability and overall running performance in both amateur and competitive runners. However, this study was subject to multiple interventions due to its design which prevented it from concluding that sheathing training improved running performance.
Finally, Rachid Ziane (2016) proposed in his study "Gainage and proprioception" that trainers should avoid reconciling fast and long rehearsal sessions and strength training in the same session when the objective is to develop maximum strength.
These studies have indeed shown a positive impact of training on the improvement of body stability, it does not translate into any improvement in performance (Sandrey & Mitzel, 2013 ; Schilling, Murphy, Bonney, & Thich, 2013), which encouraged us to try to research this important factor and verify its contribution to performance.
Our study is to determine whether simultaneous training of sheathing and endurance would positively influence the endurance performance of walkers as opposed to a program without sheathing. More specifically, by trying to answer the question :
Does a sheathing program positively influence the endurance performance of walkers ?
In this study, the following null hypotheses were tested: there will be no significant difference in performance (5km walk, VO_2max) between the experimental group and the control group after following different types of training (endurance training with sheathing and without sheathing).

II. METHODS AND MATERIELS.

1. Evaluation period :

The study was conducted during the first pre-competitive phase of the season between February and March 2018. Sheathing training is performed twice a week and consists of three progressive exercise levels that focus on strengthening the abdominal, lower back and pelvic muscles through a variety of exercise positions, which in addition to developing body stability, allow for improved balance and better neuromuscular and motor control.
The exercises are repeated from week to week with progressive loads.

2. Participants

Twelve (12) athletes who practice race walking are members of the National Team. They train with the same coach and follow a similar training program. These athletes are characterized by tha national and international level of performance. They have at least 6 years of training and 5 years of competitive experience, they train 6 to 7 times a week for 2 to 3 hours per training session.
We can therefore consider them as athletes of appreciable level. The anthropometric characteristics of the athletes are presented in the Table 1 on the shape (mean ± standard deviation). At the beginning of this study, no athletes reported any medical or orthopaedic problems that would interfere with the conduct of this study.
The population is randomly divided into two groups. The sheathing group (GE, n = 6) which applies sheathing training in addition to basic training. The second group, which is called the control group (GC, n = 6), will not apply the sheating training, but will perform only the basic training.
Based on the results presented in Table 1, we can said that the two samples are homogeneous since the t-test does not reveal any significant difference between the two groups for any of the variables.

Table 1-Anthropometric and training characteristics of the study population.

Variables	GE	GC	t-test (p-value)
Age (years)	20,00 ± 1,26	20,16 ± 0,75	0,78
Height (cm)	177,00 ± 3,74	179,33 ± 4,71	0,36
Poids (Kg) 5 km walk (min)	67,50 ± 3,27 21.01 ± 0,65	65,66 ± 5,08 21.10 ± 0.51	0,47 0.80
Experiments (years)	6,33 ± 1,03	6,83 ± 0,75	0,36
Competitions (years)	5,88 ± 1,47	6,32 ± 0,51	0,35

Notes : GG = Sheathing group (n = 6), GC = Control group (n = 6). t-test difference between groups is non-significant (p > 0.05).

3. Procedure

The study begins with a series of one-week pre-tests that will be used to assess the athletes' fitness and performance levels and will serve as benchmarks for comparison with post-tests. Then comes the six-week training period where the experimental group (EG) will apply combined basic endurance training and training with gainage, while the control group (CG) will apply the same basic training, but without including gainage training. After the six-week training period comes the one-week post-test period, which will be done according to the same protocol and conditions as the pre-tests.

Subjects begin the test sessions with a 15-minute warm-up, which consists of cardiovascular activity such as cycling, running or walking at 150 bpm calculated using a heart rate meter for each athlete, followed by dynamic stretching and mobility exercises.

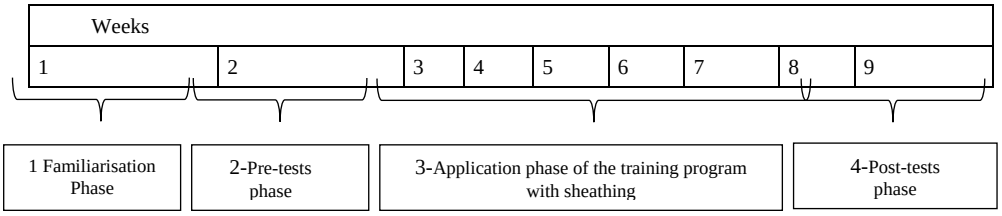

Figure 1- Schematic representation of the study protocole.

We used seven tests (Double leg lowering, test, the McGill sheathing test (lumbar extension, abdominal fatigue and lateral sheathing), the Cooper test, the VAM and VAL test and the 05 km walk). A period of one day separates each test to allow a better recovery of the body and to avoid a delayed effect of fatigue that can eventually influence the performance of the other tests.

On the first day the double leg lowering test and the McGill test will be performed to evaluate the stability of the abdominal muscles, after a period of one day of rest the athletes perform the Cooper test to calculate the VO_2max, then the VAM and VAL test will be performed after a day interval. At the end for the last day, the athletes proceed to the endurance test specific to walking which is the 05 km walk, always respecting a phase of one day of rest between the tests.

The sheathing training is completed twice a week, after the warm-up and before the main training with a duration of thirty minutes (30 min) over a period of six 6 weeks for a total of twelve training sessions. During this

program, all athletes are observed during the execution of the various exercises to ensure that they are performed correctly.

According to Haugen, (2014) a period of 6 weeks is sufficient to achieve significant improvement at the rate of two training sessions per week (Marques, 2013). We therefore justify the choice of this duration for our study.

4. Tests and measurements

Several tests evaluating endurance and sheathing (stability) are used, each test is performed once during the pre-test period and the post-test period. The choice of tests was based on bibliographic sources ; local and organizational conditions.

4.1. The Double leg lowering test

In this test, the stability of the abdominal muscles is measured by their ability to keep the pelvis in a posterior tilt and hold the lumbar spine flat. A sphygmomanometer is inflated to 40 mmHg and is used to determine when the athlete lifts the lumbar spine off the table. The examiner places the sphygmomanometer under the position of the athlete's back adjacent to the upper posterior iliac spines. The participant tilts the pelvis posteriorly to push the lumbar spine flat on the table by contracting the abdominal muscles. The mercury reading must exceed the predetermined pressure of 40 mmHg.

4.2. The McGill sheathing test

Sheathing capacity was measured by the four McGill tests. For the lumbar extension test the Biering-Sorensen test is used, where the upper part of the body is off the table with the legs secured by a strap and a towel. The arms are crossed at chest level with the hands on the shoulders. The test begins when the athlete maintains 180° position and ends when the position is no longer maintained and the time is recorded in seconds.

The abdominal fatigue test was performed by having the athlete sit on a bench with a back support that was positioned at a 60° angle. The athlete leaned on a 4 cm thick bench that was placed on the athlete's back at a 60° angle. The time is recorded in seconds.

The lateral bridge test begins with the subject checked on one side with outstretched legs. Athletes are asked to support their bodies only with the elbow, forearm and feet. The hips were lifted off the ground forming a straight whole body position on the frontal plane. The test was stopped when the hips began to collapse.

4.3. The VAM and VAL test

This progressive test is carried out by walking at a speed progressively accelerated in one-minute increments. The steps are 0.5km/h, with blocks spaced 20m apart on an athletics track. At each beep, the runner must find himself at the next block. The speed will gradually increase by 0.5km/h every minute. After a certain amount of time, the runner will not be able to reach the pylon at the time of the beep. This is called "stalling". The test thus ends and the last stage completed will allow the V.M.A. to be extrapolated.

4.4. The Cooper test

The aim is to cover the greatest possible distance in 12 minutes. It allows an indirect evaluation of the VO_2max, using the following formula, which according to (Bandyopadhyay, 2015; Lima, Silva, & Souza, 2005) is a very reliable indicator of the VO_2max following the study it undertook.

4.5. The specific 5 km walk test

This test only measures endurance specific to race walking and helps to determine the performance of athletes on the 5000 m walk. This test consists of walking the 5000 m walk in the shortest possible time.

5. Description of the training protocol

This study is conducted during the first pre-competitive phase of the season between February and March 2018. Sheathing training is performed twice a week and consists of three levels of progressive exercises that focus on strengthening the abdominal, lower back and pelvic muscles through a variety of positions and exercises, which in addition to developing body stability, improve balance and enhance neuromuscular and motor control.

Training with sheathing consists of doing a modality of exercises presented in tables 2 and 3. During all the exercises the athletes use their body weight, physio ball and bosco balls. The different exercises are repeated from week to week, but with more difficulty, adding a movement or replacing the type of surface. The training protocol with sheathing begins towards the end of February.

III. RESULTS :

Table 2-Schematic illustration of sheathing exercises to be done during training.

Weeks	Sheathing exercises Execution of the exercises is (Time in secs x series) with 20 seconds of recovery between series and exercises.								
	Shoulder Bridge	Full Plank	Prone Bridge	Abdominal Crook *	Side Bridge*	Supine Bridge**	Diagonal crunch**	Pitcher squat***	Back Bridge***
Week 1	25 x 2	20 x 2	20 x 2	15 x 2	20 x 2	25 x 2	15 x 2	20 x 2	20 x 2
Week 2	30 x 2	25 x 2	25 x 2	20 x 2	25 x 2	30 x 2	20 x 2	25 x 2	25 x 2
Week 3	40 x 2	30 x 2	30 x 2	25 x 2	30 x 2	35 x 2	25 x 2	30 x 2	30 x 2
Week 4	40 x 2	35 x 2	35 x 2	30 x 2	35 x 2	40 x 2	30 x 2	35 x 2	35 x 2
Week 5	45 x 2	40 x 2	40 x 2	35 x 2	40 x 2	40 x 2	35 x 2	40 x 2	40 x2
Week 6	45 x 2	45 x x2	45 x 2	40 x 2	45 x 2	45 x 2	40 x 2	45 x 2	45 x 2

Note : * = on each side, ** = on physioball, *** = with swisse ball

Table 3-Schematic illustration of dynamic sheathing exercises.

Weeks	Exercices de gainage dynamique. Exécution des exercices est (Répétition x séries) avec 10 secondes de récupération entre les séries et les exercices								
	Hip Crossover	Multi Directions lung	Reverse Crunch	Jack knif*	Knee Drive*	Hip thrust**	Knee Tucks**	Russian Twist***	Crunch Ball Hold
Week 1	8 x 2	20 x 2	20 x 2	8 x 2	20 x 2	25 x 2	12 x 2	8 x 2	8 x 2
Week 2	10 x 2	25 x 2	25 x 2	10 x 2	25 x 2	30 x 2	16 x 2	10 x 2	10 x 2
Week 3	10 x 2	30 x 2	30 x 2	10 x 2	30 x 2	35 x 2	20 x 2	12 x 2	14 x 2
Week 4	12 x 2	35 x 2	35 x 2	12 x 2	35 x 2	40 x 2	24 x 2	14 x 2	16 x 2
Week 5	12 x 2	40 x 2	40 x 2	12 x 2	40 x 2	40 x 2	24 x 2	16 x 2	18 x2
Week 6	14 x 2	45 x x2	45 x 2	16 x 2	45 x 2	45 x 2	26 x 2	16 x 2	20 x 2

Note : * = on each side, ** = on physioball, *** = with swisse ball

Statistical analysis

Two groups, one experimental and one control (GE and GC) will follow a 6-week training with the same basic program, but for the EG in addition to basic training, he's going to take a sheating program. The dependent variables used (5km walk, VO_2max, VAM, sheating capacity) are quantitative variables. The variable independent that in fact to manipulate is the training program with sheathing. As the goal of the study is to show the effect of the training protocol with and without sheathing on the variables

dependent, so we have two conditions with or without training and two groups (GE and GC). To do this, we will process the data collected using parametric tests after verifying that the results follow the conditions of variance homogeneity and normality of distribution. So, we use an analysis of variance with ANOVA with repeated measurements. Independent and matched t-tests were used for post hoc comparisons.The p-values were corrected by the Bonferroni method. In order to carry out our statistical processing, we used the open source JASP 0. 8.5.1 the significance threshold of the set of results is set at $P < 0.05$.

The ANOVA showed no significant deference with $p > 0.05$ between pre-tests and test stations in both GE and GC groups after having followed differenttraining for all of the following variables ; VO_2mas, VMA, 5 km walk and abdominal fatigue. On the other hand, the analysis of variance did not show a significant difference on the following variables ; double leg lowering, lumbar extension and right and left lateral sheathing with percentages of progression up to 52% compared to the pre-tests in both groups but with a significant improvement in the experimental group.

IV. DISCUSSION

The objective of this study was to examine the improvement of a training program with the isometric method and the 6-week endurance on the performance of the walkers, (represented by the following variables which are VO_2max, walking economy, 5 km walking performance and the capacity of the

sheathing represented by the double leg lowering (DLL), abdominal fatigue, lumbar extension and lateral sheathing) compared to a training without sheathing.

The results of this study show a similar improvement in the performance of the two groups (GE and GC) following the implementation of the two endurance training protocols with and without isometric training. Indeed, we noted a significant improvement of (9.8 %) on the VO2max from (53 ± 2.366 to 58.17 ± 1.472, p=0.001) and (3.6 %) on the 5 km walk progressing from (20.87 ± 0.4857 to 20.12 ± 0.417, p<0.001) for the experimental group. For the control group,

almost identical percentages were recorded following training without the isometric method with a significant improvement of (4.8 %) on the VO_2max

from (54.00 ± 2.683 to 56.67 ± 2.338, p<0.001) and an improvement of (2.5 %) on the 5 km walk progressing from (21.13 ± 0.417 to 20.60 ± 0.396, p<0.001).

Comparing the results of the tests in the two groups for each variable presented above, no significant difference was noted, which indicates that the two forms of training resulted in an increase in the performance of the two variables VO_2max and the 5 km walk in the two groups, but with no significant difference between them.

Analysis of the results of the other variables (double leg lowering, lumbar extension, right and left lateral sheathing and abdominal endurance) in the different tests shows that both groups significantly improved their performance compared to the pre-tests, but the experimental group managed to record significant improvements in the post-tests compared to the control group's post-test results, following endurance training and the isometric method with percentages of (52%) on double leg lowering (Dll) going from (29.67 ± 6.532) to endurance with and without the isometric method. Indeed, for the experimental group, we noted a significant improvement of (9.8 %) on the VO_2max passing from (53 ± 2.366 to 58.17 ± 1.472, p=0.001) and of (3.6 %) on the 5 km walk progressing from (20.87 ± 0.4857 to 20.12 ± 0.417, p<0.001). We noted significant (4.8%) improvement in VO_2max from (54.00 ± 2.683 to 56.67 ± 2.338, p<0.001) and an improvement of (2.5%) over the 5 km walk from (21.13 ± 0.417 to 20.60 ± 0.396, p<0.001) p=0.002), (31%) on lumbar extension from (45.50 ± 3.564 to 59 ± 5.115, p=0.002), (29%) on right lateral isometric work from (45.33 ± 4.131 to 58.67 ± 6.470, p=0.002) and a progression of (24%) on left lateral isometric work from (45 ± 2.898 to 56.17 ± 3.312, p<0. 01). No significant difference between the tests in the two groups for the abdominal endurance variable (t(10)=0.155, p=0.880) with mean GE (80 ± 8.168) GC (76.83 ± 5.913), which demonstrates that isometric training brings a significant and positive improvement on the strength capacity which according to (Paavolainen, Häkkinen, Hämäläinen, 1999) would allow an improvement of the performance in endurance by a better neuromuscular control, a better restitution of energy at the time of the contact on the ground because of the increase of the muscular stiffness which allows a better use of the muscular elasticity which results in a reduction of the time of contact on the ground thus a better economy of race.

Although little research exists on this subject, those of (Sato & Mokha, 2009) show a positive effect on the performance of both groups, positive

effect of winning on performance in endurance sports, where a training programme in endurance with a 6-week sheathing for 3 sessions per week of 30.

Stanton et al., (2004) noted no significant improvement in endurance peformance after an 8-week training protocol with sheathing for 2 sessions of 30 min per week in university level rowers with no significant improvement in VO2max, energy cost, despite the observation of a significant improvement on the lateral sheathing, lumbar extension and abdominal flexion tests. Similar results to the research done by (Cosio-Lima, Reynolds, Winter, Paolone, & Jones, 2003; Schilling et al., 2013) min significantly improved performance over 5000 m run in national-level runners, but without any other observed advantage in running economy and VO_2max. Our study shows a similar progression of endurance performance between the two groups and supports the results observed by those who tested the effect of training with gainage on performance using static versus dynamic exercises on university level athletes. The results show a significant development in core muscle strength and endurance ; however, these benefits did not translate into improved performance in jumping, sprinting or medicine ball throwing.

Thus, more research is needed to study the mechanisms and protocols for the use of sheathing including performance enhancement. In addition, while some research supports the positive effect of training with body armour on performance, this has not been confirmed by our study which showed that 6 week training with body armour has no effect on endurance performance (VO_2max, energy cost and 5 km walking) compared to training without body armour although significant improvements in core muscle stability and strength were observed following training with body armour, but without any effect on the endurance performance of the walkers.

V. CONCLUSION

The results indicate that simultaneous endurance and sheathing training improves the sheathing capacity of the core muscles. However, this improvement does not have a significant effect on improving the endurance performance of walkers. The experimental group recorded an improvement in endurance performance by improving VO_2max and 5 km walking, however, the difference between the groups was not significant. These results are consistent with other research that demonstrates improvements in sheathing ability with no significant change in performance (Tse et al 2005).

Some research also demonstrates that simultaneous endurance training with sheathing can have a significant influence on performance in 5000m and intermittent sports suggesting that sheathing training may be an effective additional training for performance improvement in some sports (Sato & Mokha, 2009).

However, it should be understood that the results of this study cannot be applied to the study population. The results of this study may contradict the current thinking and practices of athletes and coaches, they do not discourage the use of sheathing because it is evident and other research shows that it has a positive effect on improving sheathing capacity.

The impact of sheathing on performance and in endurance sports such as race walking remains unanswered and future studies should investigate the manipulation of program variables and exercise selection.

The use of sheathing alone or as a complement to training to improve stability and sheathing capacity appears promising. However, it remains to be demonstrated whether the gains in capacity of the obtained gain in gainability will be converted back into an improvement in final performance.

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