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The effect of a running program on body composition during the transition period

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ABSTRACT

During the transition period, some coaches are content only to give verbal instructions encouraging the players to do sporting activities or, sometimes, to ask them to carry out voluntary training, often unplanned, in order to avoid a drop in their condition physical. However, a total cessation or virtual absence of training stimuli could have negative repercussions on the physical condition of players and the performance forged by training (Mujika and Padilla, 2000) (Koundourakis & al., 2014) . Indeed, several studies have concluded that a period of cessation, as well as a reduction in training frequencies cause alterations in body composition and physiological functions, which can lead to a partial or total loss of certain adaptations induced by training (Buchheit & al., 2015; Stergios & al., 2018) The aim of this study is to examine the effect of a running program, carried out through the POLAR system, on the body composition of affected soccer players during the transition period.

Keywords: running; body composition; transition period ; POLAR

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INTRODUCTION

During the transition period, some coaches are content only to give verbal instructions encouraging the players to do sporting activities or, sometimes, to ask them to carry out voluntary training, often unplanned, in order to avoid a drop in their condition physical. However, a total cessation or virtual absence of training stimuli could have negative repercussions on the physical condition of players and the performance forged by training (Mujika & Padilla, 2000) (Koundourakis & al., 2014) . Indeed, several studies have concluded that a period of cessation, as well as a reduction in training frequencies causes alterations in body composition and physiological functions, which can lead to a partial or total loss of certain adaptations induced by training (Buchheit & al., 2015; Stergios & al., 2018)

The loss of physical and/or physiological abilities during a period of cessation arouses the interest of experts in the sports world by pushing them to implement exercise protocols that will enhance at least one of these abilities in order to increase performance. Overall A rest period of 6 to 12 weeks is sufficient to reduce aerobic capacity and lead to an increase in body fat percentage (Muñoz-Martínez & al., 2017). High-intensity aerobic (interval running) training has been widely used by athletes to improve physical fitness during the transition period. Indeed, a study demonstrated that high-intensity aerobic training (4 phases of 4 min at 90 to 95% of max HR) during transition significantly improved aerobic fitness and performance in soccer players (Impellizzeri & al., 2006). Given the need to continue training in order to avoid the negative effects of stopping training during the transition period to preserve and/or improve the physical abilities of players, this leads us to ask the questions following:

- To what extent can a running program, through the POLAR system, influence the body composition of professional football players under the age of 19 during the transition period? What meaning?

• The purpose of the study

The aim of this study is:

1) To examine the effect of a running program carried out through the POLAR system, on the body composition of football players affected by the lack of physical activity during the transition period.

2) To avoid the harmful changes that can occur on the body of the players during a period of stoppage, by relying on the technological tools available to us.

1. The methodological procedures used in the study

1.1. Type of study and research methods

The experimental method is used in this study throughout the transitional period, the main objective of which is to make it possible to establish cause and effect relationships between the variables studied.

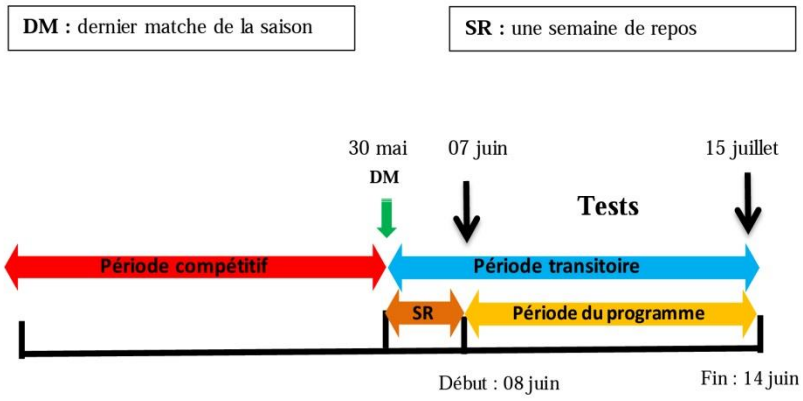
1.2. The research population

We selected 16 participants from among 25 players aged 17 to 18. Then, two sealed envelopes were designated containing the name of the group to which they were randomly assigned (i.e., group with running program (GP n=08) or control group (GT n= 08) without any training program). The characteristics of each group (mean ± SD) of the GP and GT respectively, were: age, 18.91 ± 0.9 and 18.71 ± 0.9 years; stature, 174.62±0.02and 178.25±0.03cm; weight, 68.38 ± 2.26 and 67.52 ± 2.8 kg; body fat, 06.91 ± 0.54 and 06.77 ± 0.51%. All the players in the study trained around 2 hours a day for 4 to 5 times a week (excluding matches) during the previous season. The average practice time of players is +7 years.

1.3. Intervention period

A one-week recovery period (SR) began immediately after the last game (DM) of the 2020-2021 sports season.

Fig.1. Schematic illustration of the experimental design



Weight and body fat measurements were taken one week after the last DM match as a PT pre-test (June 07, 2020), before the start of the program (June 08, 2020), and the same measurements were taken one day after the end of the last week of the running program as a post-test AT (July 15, 2020).

1.4. The means of research

1.4.1. Body composition

1.4.1.1. Weight (kg) and stature (cm)

Both measurements were made in light clothing, without shoes, using an electronic scale (± 0.1 kg) and a stadiometer (± 0.1 cm) (Seca 702, SecaGmbH& Co. KG , Hamburg, Germany).

1.4.1.2. Percentage of body fat

Skin fold thickness was estimated using a Harpenden caliper (John Bull, British Indicators, Ltd., West Sussex, UK) Fat percentage values were estimated using a skin fold caliber following the measurement of the thickness of 4 different sites: biceps, triceps, supra-iliac, sub-scapular.

The calculations were made with the application of the Durnin and Womersley equation, validated with both sexes (Peterson & al., 2003), and widely used with young athletes (Hodgdone & al., 1996) Several studies have adopted because of its validity compared to other more expensive methods (Zahariev & al., 2005).

This equation therefore seems relevant for measuring the body composition of athletes, because of its ease in terms of execution, its reproducibility, and its recognized specificity with respect to sports populations.

BD = C - [M (Log10 Σ4plies)]

Σ 4 folds: Biceps + Triceps + Subscapularis + Suprailiac C: 1.1620

M: 0.0678

- **Conversion of body density (BD) to %MG:**

Generally, two equations are validated in the whole of the scientific literature in order to convert the body density into % MG, that of Siri and Brozek (Khalid & Bibi, 2006) The Siri equation remains the most used, although it slightly

overestimates the %MG in athletes, especially with light weight compared to the hydrostatic method) (Siri, 1956; Modlesky & al, 1996)

Équation de Siri %MG =	**495/BD – 450**
Équation de Brozek %MG =	**457/BD – 414,2**

The many studies carried out with the aim of validating Sirila's equation make it the reference method for calculating %MG from body density, starting with athletes (Khalid.W & Bibi.D, 2006) It is otherwise used for this conversion. The collected results transmitted to the computer for processing, according to the equations given below.

- **General principles to be respected:**

- The measurements are carried out by the same operator;
- Measurement of skin folds, always on the right hemi body, by convention (for left-handers and right-handers)
- Complete relaxation of the subject is essential, without contraction of the underlying muscle;
- The member concerned completely relaxed;
- The fold must be printed between the thumb and the index finger;
- The fold concerns the skin and the subcutaneous tissues, but must exclude the underlying muscle mass and the aponeuroses;
- The pressure of the fingers must be released during the measurement with the clamp;
- The measurement with the forceps must be made perpendicular to the skin surface, by an isolated pressure of about 2 seconds on the selected point;
- The measurement must be repeated on each site at least 3 times, ideally 5 times, on an area centered on the initial point (2 mm).
- The value retained corresponds to the average of the 5 measurements.

1.4.2 Material:

A swaddling type forceps was used. This material remains the reference material to be adopted. It also requires no secondary calibration or special maintenance.

Bicipital fold:

Vertical fold, located halfway between the high (humeral head of the shoulder) and low (elbow fold) insertion.

Fig. 2. Bicipital Folds

Fig. 3. Tricipital folds

Triceps Fold:

Vertical fold on the posterior surface of the Triceps, Arm completely relaxed (avoid rotations of the limb). Half way between the high (Acromion of the shoulder) and low (Olecranon of the elbow) insertion.

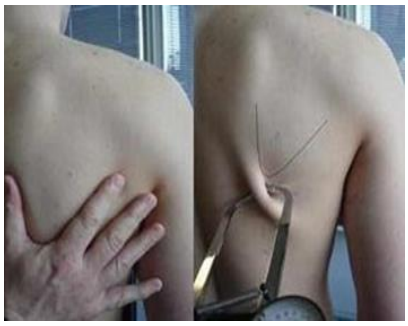


Fig. 4. Sub-Scapular Folds

Fig. 5. Supra iliac folds

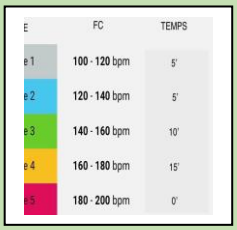
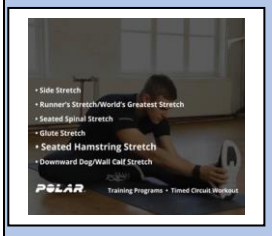
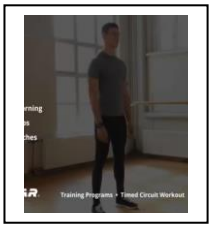
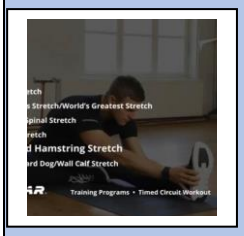
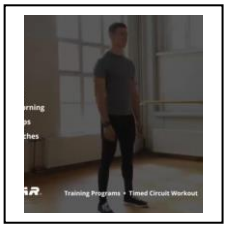
Under Scapular Fold: Oblique fold downwards and outwards, on the posterior face, the arm quite relaxed. The fold is located just under the tip of the shoulder blade (1 cm).

Supra iliac fold: Oblique fold downwards and inwards. Just above the iliac crest (2 cm), at its intersection with the anterior axillary line.

1.4.3. Statistical techniques

Statistical analysis was performed using SPSS.25 software to determine the means and standard deviations (±SD), unpaired Student's t-test to compare the two groups, and paired Student's t-test to compare the results of the same group before and after the running program, the significance level was set at $p < 0.05$.

1.4.4. The running program offered with the POLAR system (Caminal, P., & al 2018)

Sunday	Monday	Tuesday	Thursday	Saturday
(Warm-up (5 mins Articular, mobility and active stretching	*(Warm-up (5 mins Articular, mobility and active stretching*	*(Warm-up (5 mins Articular, mobility and active stretching*	*(Warm-up (5 mins Articular, mobility and active stretching*	*(Warm-up (5 mins Articular, mobility and active stretching*
Basic program 'Continuous run 45 70 to 80% 		***Basic program tempo race '35 80 to 90%*** 	***Basic program 'Race-interval 24 90-100%*** *HIT (intervalle long) 2× [3 × 4'] repos/rep : 2' repos/ser : 4'*	
Static mobility [1] *Side Stretch* *Runner's Stretch/ World's Stretch* *seated spinal stretch* *Glute Stretch* *Seated Hamtring stretch* *Down ward Dog/ Wall Claf Stretch* 	***Reinforcement muscular*** [2] ***(level 1)*** *Squat* *Push-up* *Good morning* *Chair dips* *Ab crunches* 	***Static mobility*** *Side Stretch* *Runner's Stretch/ World's Stretch* *seated spinal stretch* *Glute Stretch* *Seated Hamtring stretch* *Down ward Dog/ Wall Claf Stretch* 		***Reinforcement muscular*** [3] ***(level 1)*** *Squat* *Push-up* *Good morning* *Chair dips* *Ab crunches* 

• The 45' continuous run (70 to 80% FCM): the objective of this session is to

1. Mobilité statique [1] ***:*** ***https://www.youtube.com/watch?v=NGulrkzcEaQ&t=3s***

2. Renforcement musculaire [2] ***(niveau 1) :*** ***https://www.youtube.com/watch?v=qn-mwjbtROw***

Renforcement musculaire [3] ***(niveau 2) :*** ***https://www.youtube.com/watch?v=OJLOzXQj5n8&t=1s***

Renforcement musculaire [3] ***(niveau 3) :*** ***https://www.youtube.com/watch?v=Es9ygKl5O-Y***

maintain the fundamental endurance which represents the basis of training. Indeed, this type of running improves the cardiovascular system and accustoms the body to a larger volume of training.

• The 35' tempo race (80 to 90% FCM) (race at the lactic anaerobic threshold): The goal of the Tempo-Run is to run a little below the lactic anaerobic threshold in order to "push it back". This type of session therefore allows us to gradually push back our lactic anaerobic threshold and thus go faster without generating significant fatigue.

• The 24' HIIT: (90 to 100% FCM) this type of race is very well known for its multiple advantages (cardio-respiratory capacity, vascular functions and adipose mass, etc.). The HIT was organized as follows: two sessions of long-interval HIT runs [i.e. 3 × 4 min (90-100% HR)/2 min rest between reps, and 4 min between series].

2. Result of the two groups after the implementation of the race program

Table 1. Body composition values (mean ± SD) before and after application of the program for the experimental group (< 0.05)

axe / VARIABLES	Test	Mean	p-value	t Calculated	t Table	DF
Poids (Kg)	pre-test	68,38 ± 2,26	0,3522	-0,9965	1,895	07
	post-test	68,61± 1,91				
% MG	pre-test	06,91 ± 0.54	0.8074	0.2532		
	post-test	06.85 ± 0.62				

Table 2. Body composition values (mean ± SD) before and after application of the program for the control group (< 0.05)

axe / VARIABLES	Test	Mean	p-value	t Calculated	t table	DF
Poids (Kg)	pre-test	67,52± 2,8	0.0004	-2,3231	1,895	07
	post-test	68,64 ± 2,83				
% MG	pre-test	06,77 ± 0,51	0,004	-4.1366		
	post-test	07.68 ± 0.80				

Fig.6. Weight values for the two groups (experimental and control) before and after the tests

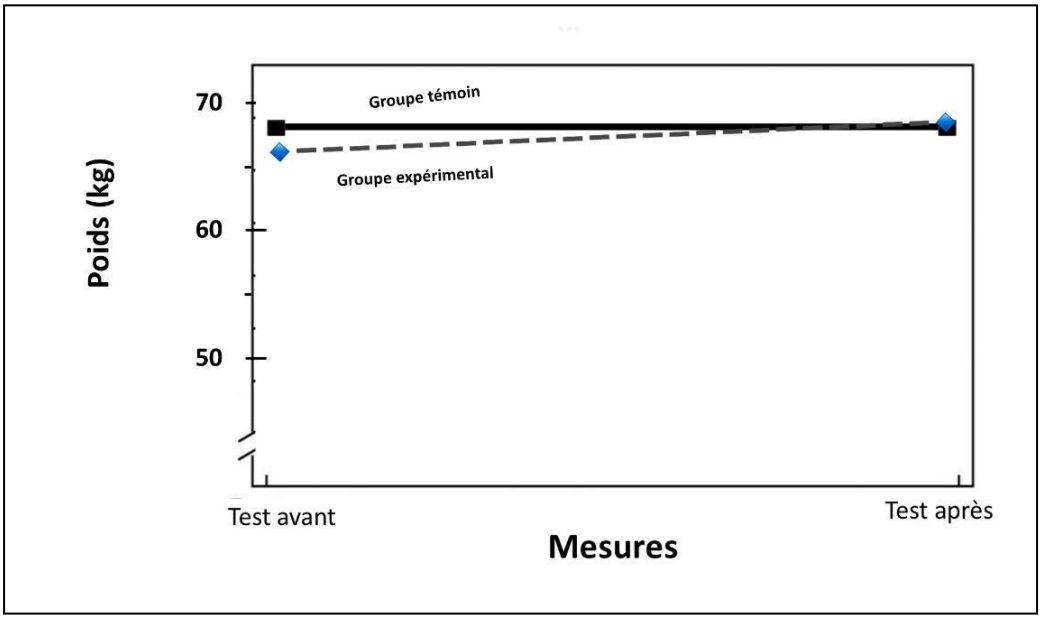
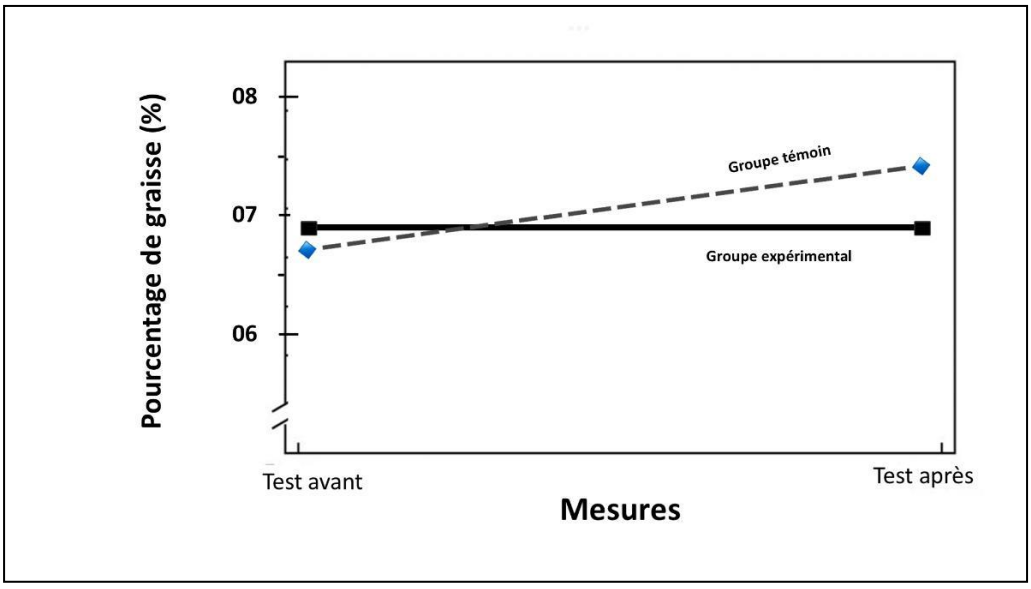


Fig.7. Fat mass values for the two groups (experimental and control) before and after the tests



3. CONCLUSION

Statistical analysis of the weight data indicated that the results within the experimental group (table.1, feg.6) did not reach a change leading to statistical significance ($p > 0.05$). Indeed, the data for the measurements of the experimental group were (68.14 ± 4.77; 68.74 ± 5.00) respectively. In contrast, the measures of the control group reached a statistically significant level ($p = 0.0004$; $p < 0.05$). Indeed, this change which affected the control group had an impact on the increase in total weight in the post-test measurements (68.64 ± 2.83) compared to the pre-test measurements (67.52 ± 2.8) However, both groups showed increases in body weight but with non-significant values for the experimental group (0.23 kg) and statistically significant for the control group (1.12 kg). The results of the analysis of the data concerning the percentage of the fat mass (table.2, fig.7) indicated a stability of the values concerning the experimental group (06.91 ± 0.54 and 06.85 ± 0.62) compared to the control group which recorded a significant increase (06.77 ± 0.51 and 07.68 ± 0.80, $p = 0.004$; $p < 0.05$). Further analysis of the aforementioned differences indicated that the control group (0.91%) gained significantly more body fat than the experimental group (0.06%).

At the end of the 6-week transition period, significant increases in body weight and body fat percentage were evident for the GT control group. These results are consistent with what is proven in other scientific studies (Ostojic, 2003; Hoshikawa & al., 2004) which have confirmed that the transition period can lead to an increase in body weight and body fat percentage in players. However, in these studies, no off-season training sessions were undertaken. Confirmation of our findings comes from a recent study conducted on professional swimmers (Ormsbee & Arciero, 2012) The authors reported that 35 to 42 days of detraining, involving light to moderate physical exercise, after a competitive sports season, resulted in significant increases in weight and body fat percentage. The increase in body fat percentage and body weight, in our study, could be attributed to decline in physiological stress caused by physical exertion during the preparatory and competitive period. This reduction in training stimulus could have resulted in a lower metabolic rate per unit of resting tissue mass, which could have a negative impact on body composition (Ostojic, 2003; Ormsbee & Arciero, 2012). Additionally, lipoprotein lipase (LPL) activity has been observed to increase during a period of detraining, which facilitates free fatty acid deposition in adipose tissue (Hardman & al., 1998). In conclusion, the insufficient training stimulus during the transition period resulted in weight gain, characterized by increased fat mass, most likely

due to increased deposition of free fatty acids in adipose tissue.Due to increased lipoprotein lipase (LPL) activity (Hardman & al., 1998; Ormsbee & Arciero, 2012).

According to our results, the running program during the transition period had a significant and positive impact on the body composition (weight, and fat mass) of players of a professional football team aged Under 19. Indeed, this program has helped players maintain body composition waltzers. This hypothesis was confirmed in a study conducted by (Sotiropoulos & al., 2009) on the implementation of a training program during the transition period; in fact, soccer players who followed a four-week training program had significantly lower levels of body fat than those who did not follow a specific training program. Other studies have also confirmed the close relationship that may exist between a HIIT running program and weight loss (Trapp & al., 2008; Boucher, 2011).

4. FINDINGS AND RECOMMENDATIONS

All of the scientific literature supports the idea that stopping training (transition period, COVID-19, diseases or others) leads to changes in body composition and generates a deficit in the neuromuscular and cardiovascular system and, by therefore, causes a loss of strength, speed, flexibility and endurance which increases the risk of injury, unless specific training programs are implemented. However, a high level of VO2max has been correlated with several physical qualities and technical-tactical aspects. For these reasons, football training programs must include the aerobic mode. A conclusion recalls the role of different technological tools, the consideration of which is a guarantee of success and a driver of change within a session or a training program, keeping the course on the performance of the players.

We recommend that clubs, coaches and clinical departments should consider the points covered when prescribing an individualized training program for the transition period. This study should be part of a larger study to examine hormonal and enzymatic adaptations, and physiological and biochemical parameters during the transition period in professional footballers.

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