Artigo Original

Free-throw accuracy and success as a function of ball weight in 9- to 11-year-old male players

José Luis Arias

Department of Physical Activity and Sport Sciences,
Catholic University St. Anthony of Murcia, Murcia, Spain

Abstract: The goal of this study was to analyze whether 9-11 years old children can attain more free-throw accuracy and success by modifying the ball weight in basketball game. The participants were 54 children (age: mean=10.63, SD=0.55 years) from six basketball teams. The participants played four games with each of the following balls: (a) standard ball weight (485 g, 69-71 cm), (b) a lighter ball (440 g, 69-71 cm), and (c) a heavier ball (540 g, 69-71 cm). The procedures adopted in the study were: (a) defining the variables, (b) instructing the observers and obtaining reliability, (c) monitoring the properties of the ball and filming the games, and (d) recording the data from the observation. The results revealed statistically significant differences for free-throw accuracy ($\chi 2=1.76$, df=2, p=.050) and success ($\chi 2=5.69$, df=2, p=.048). Free-throw accuracy and success were higher with the 440-g ball than with the 540-g ball.
Keywords: mini-basketball; children; rules modification; team sport; game analysis.

Precisão e êxito em função do peso da bola em jogadores de 9 a 11 anos de idade

Resumo: O objetivo deste estudo foi analisar se crianças de 9 a 11 anos poderiam alcançar maior precisão e êxito no lance livre em função de diferentes pesos da bola no basquetebol. Participaram do presente estudo 54 crianças (idade: M=10.63, SD=0.55) de seis equipes de basquetebol. Os participantes jogaram quatro jogos com cada um das seguintes bolas: (a) bola regulamentar (485 g, 69-71 cm), (b) bola menos pesada (440 g, 69-71 cm), e (c) bola mais pesada (540 g, 69-71 cm). Os procedimentos seguidos foram: (a) definição das variáveis, (b) formação dos observadores e obtenção da confiabilidade, (c) controle das propriedades da bola e filmagem dos jogos, e (d) gravação dos dados de observação. Os resultados revelaram diferenças estatísticas significativas para precisão ($\chi 2=1,76$; df=2; p=0,05) e êxito do lance livre ($\chi 2=5,69$; df=2; p=0,048). A precisão e êxito do lance livre foram mais elevados com a bola de 440 g em comparação com a bola de 540 g.
Palavras-chave: mini basquetebol; modificação de regras; esporte coletivo; análise de jogo.

Introduction

Shooting ability is very important in youth basketball games for three reasons: (a) is the action that directly leads to points, (b) is the action that young basketball players most prefer (PALAO et al., 2004), and (c) is one of the aspects from which children claim to derive the most fun and with which they feel best performing (PIÑAR et al., 2007). Free throw is one of the game situations where shooting is obligatory. However, children normally lack the strength and physical characteristics demanded by the shooting performance. Therefore, teachers and coaches must find strategies and think of ways to solve the problem. The purpose of this study was to analyze whether modification of ball weight could contribute to decreasing the deficiencies in strength displayed by children.

High shooting performance values produce a positive practical experience. Therefore, the theoretical proposals determine that successful shots contribute to increasing motivation (AMERICAN SPORT EDUCATION PROGRAM [ASEP], 1996; GRAWER; RAINS, 2003; HANLON, 2005; PIÑAR, 2005). It is therefore necessary for children to attain positive performance results (ARIAS et al., 2009; CHASE et al., 1994; ISAACS; KARPMAN, 1981; JUHASZ; WILSON, 1982; PIÑAR, 2005; REGIMBAL et al., 1992; SATERN et al., 1989).

Lack of strength is the main reason why children's shooting performance is not more accurate and successful (CHASE et al., 1994; CLEARY et al., 2006; JUHASZ; WILSON, 1982). The lack of strength, in addition to preventing the ball from reaching the basket, also hinders the adequate placing and use of body levers. This leads to inaccurate shots (CLEARY et al., 2006). Weaker players increase their horizontal movements to generate the necessary speed to allow the ball to reach the basket (ELLIOTT, 1992; LIU; BURTON, 1999; MILLER; BARTLETT, 1993, 1996). This causes a decrease of angle and release height of the ball (ELLIOTT, 1992;

MILLER; BARTLETT, 1993). An increase in speed release and a decrease of angle and release height of the ball reduce shot accuracy (BRANCAZIO, 1979; TAN; MILLER, 1980).

The Teaching Games for Understanding (TGfU) approach defends the importance of modifying the equipment as a means of suiting the game conditions to the players' level (BUNKER; THORPE, 1982; THORPE et al., 1984). Thorpe et al. (1984) introduced two pedagogical principles to be taken into account with regard to modifying game conditions. The first is known as *Modification-Representation* and it implies that the adaptation of the game should maintain the basic tactical structures of the adult game, but adapting them to children's level. The second principle is *Modification-Exaggeration* and it implies that diverse aspects of the game are simplified to facilitate children's participation. Both strategies contribute to children's frequent success, but without the practice thereby ceasing to be a challenge (HOLT et al., 2002; MACPHAIL et al., 2008).

Several studies analyzed the effect of ball dimensions through free throw tests in youth basketball. Isaacs and Karpman (1981) analyzed shot accuracy according to the dimensions of the basket (2.44 m, 3.05 m) and the ball (567-623.68 g and 75 cm, 496-552.8 g and 72.5 cm). They found that shot accuracy was greater with the lowest basket and with the smaller ball. Satern et al. (1989) also studied the effects of the dimensions of the ball (567-623.68 g and 75 cm, 496-552.8 g and 72.5 cm, 467.76-552.8 g and 70 cm) and the height of the basket (2.44 m, 3.05 m) on the success and the movement pattern of the free throw. The results showed an increase in the horizontal displacement with the larger ball and a weak relationship between the subjects` standing height and average projection angle when shooting with the intermediate size ball. The height of the basket affected shot success, but the dimensions of the ball did not. Chase et al. (1994) examined the effects of the modification of ball dimensions (595.33 g and 75 cm, 538.65 g and 72.5 cm) and the height of the basket (2.44 m, 3.05 m) on shot success and self-efficacy. The participants scored more in the lowest basket, but the lighter ball had no effect on free-throw success. Regimbal et al. (1992) assessed the dimensions of children's ball preference (567-623.68 g and 75 cm, 496-552.8 g and 72.5 cm) and analyzed whether this was related to shot technique and the score that they obtained. The children preferred a ball that was smaller than the usual one and with which they improved their scoring and their shot technique.

The goal of this study was to analyze whether participants can attain more free-throw accuracy and success by modifying the ball weight. Studies that analyzed the effect of modification of ball weight on free-throw accuracy showed that the lighter ball could either increase accuracy (ISAACS; KARPMAN, 1981; REGIMBAL et al., 1992) or not affect it (CHASE et al., 1994; SATERN et al 1989). As the results of previous studies were inconsistent, we did not hypothesize about whether modification of ball weight would affect the values of the variables analyzed.

Method

Participants

The participants were 54 children (age: mean=10.63, SD=0.55 years) from six basketball teams, aged between 9-11 years. All participants had played regionally in the basketball league and in official and federate teams for 2.52 (SD=0.75) years. The amount of days of training and the total time were similar for all the teams. Each week, they practiced an average of 3.57 (SD=0.51) days for a total of 5.03 hours (SD=0.80). Three inclusion criteria were considered for participation in the present study: (a) eight coaches selected the teams from the league that had the highest playing level and were most homogeneous in age, previous experience, and game level, (b) the team participated in all the scheduled games, and (c) the children from each team were the same in all the games. This is because the teams had to accept the pre-established matches and because they could not include or exclude participants as a function of each match. The parents of the participants and the coaches completed an informed consent form to participate in the study. The Research Ethics Committee of the University approved the study (CEI 22-540).

Experimental set-up

We established three situations that consisted of all participating teams playing with three balls that differed only in their weight: (a) four games with the standard ball weight (485 g, 69-71 cm), (b) four games with the lighter ball (440 g, 69-71 cm), and (c) four games with the heavier ball (540 g, 69-71 cm). We organized a 3-day tournament consisting of 12 games in which the six teams

were randomly matched. The teams played between one and two games each day. The game ball for each game was also randomly chosen. Four games were played with each ball among all the teams. Each team played a minimum of one game and a maximum of two games with each ball.

The goal of the study was only communicated to the sports director of each team, but not to the coaches or the players so that this information would not affect the way they played. One month before, the principal researcher informed the coaches that they would play in a tournament with the following rules: (a) the players were consistently the same, (b) the participants played all the games on identical courts (28x15 m), (c) rest interval between games was a minimum of one hour, (d) each game consisted of four 10-minute periods, (e) the participants warmed up with a ball that was similar to the game ball, (f) individual defence was compulsory, (g) the height of the baskets was 2.60 m, and (h) the balls were the same in texture, colour, circumference and bounce.

Procedure

A group of six experts (three researchers specialized in basketball and three coaches with experience coaching 9-11 year-old basketball players) delimited and defined the following variables:

1. Accuracy. Score obtained according to whether the ball hit the backboard and the rim at each free throw. The experts determined the following scores from the literature reviewed (BUTTON et al., 2003; CHASE et al., 1994; LANDIN et al., 1993; REGIMBAL et al., 1992; SATERN et al., 1989): (a) zero points indicated that the subject missed the entire basket on the shoot; (b) one point was awarded if the ball hit the backboard or net only but did not go into the basket; (c) two points were awarded if the ball hit the rim or the rim and the backboard but did not go into the basket; and (d) three points indicated that the subjects made the basket.

2. Success. Zero or one points, depending on whether or not the subject made the free throw, respectively.

We created a register instrument that allowed the observers to register the number corresponding to each variable while viewing the recording at a speed of 25 frames per second.

Four observers were trained according to the training stages suggested by Anguera (2003). This process lasted 11 sessions, from one to three hours, during four weeks. The observers accumulated a minimum of 20 hours of experience. Observer reliability was obtained through intra-observer evaluation at the end of the training process. For this purpose, the observers observed 40 free-throws from a game other than the research games. Subsequently, the observers again observed the same 40 free-throws after seven days of no observation. The reliability of the observation was measured through an inter-observer evaluation at the end of the observation process. For this assessment, 15% of the free-throws of the investigation games were used. Reliability was calculated by means of the intra-class correlation coefficient. Reliability of the observers reached values between .98 and 1. Reliability of the observation reached values between .97 and 1.

We selected the weight of the ball according to: (a) the proposals that were the most extreme within those of least weight that are included in studies about ball modification, and (b) in agreement with the notion that the differences between balls should not be excessively extreme with regard to the standard ball weight. For the lighter ball, one that was close to the 467.76-g ball proposed by Satern et al. (1989) was chosen. For the heavier ball, one that was between the 538.65-g ball proposed by Chase et al. (1994) and the 552.8-g ball proposed by Isaacs and Karpman (1981), Regimbal et al. (1992), and Satern et al. (1989) was chosen.

In accordance with Crisco et al., (2005), Isaacs and Karpman (1981), Mathes and Flatten (1982) as well as with basketball regulations, the properties of the ball that were controlled were: (a) weight, (b) circumference, and (c) bounce height. Three collaborators monitored this half an hour before and after each game. They followed a protocol that was adapted by Crisco et al. (2005). This consisted of taking three measurements of each property and calculating the mean.

Two collaborators recorded the games, each one with a video camera (Everio Full HD-GZ-HD7, JVC, Japan). The camera was situated transversally to the basketball court, on the opposite side from the scoring table. The camera was placed five meters off the ground and two meters from the sideline. The focus was the

centre of the imaginary line that joins the basket and the free-throw line. As a general rule, the recording included the player with the ball and the basket.

The four observers recorded the data using a systematized register from the observation of the game videos (ANGUERA, 2003). The registering technique consisted of indicating the number corresponding to each variable on the registry instrument (ANGUERA, 2003). The unit used for analysis was the free throw. The observers used a protocol of observing each free throw two times at real speed in order to increase observation reliability. If necessary, the observers observed each free throw at a speed of 25 frames per second. The observers attended each variable in each observation. Each observer observed and registered three games. The sample for data analysis consisted of 242 free throws from 12 games, of which 106 corresponded to the four games played with the 485-g ball, 79 to the four games played with the 440-g ball, and 57 to the four games played with the 540-g ball. Selection of the free throws was through total sampling (ANGUERA, 2003).

To control the influence on accuracy and success of the moment when the participants performed the free throw, we compared both variables, considering the 10-minute game interval (i.e., because a free-throw performed at the beginning of a match could have a different result from that performed at the end). The results were not statistically significant ($p>.05$). This means that the moment of the match and the result of the scoreboard did not affect the accuracy and success of the free throws.

Statistical analysis

The statistical analysis of the data was performed with SPSS v. 17.0 for Windows (SPSS, Inc., USA). We conducted descriptive analyses of means and standard deviations. We determined the normality of the data with the Kolmogorov-Smirnov test. From this test, it was determined that the data were not normally distributed. The Kruskal Wallis H was used to assess in which categories there were significant differences. Then, post-hoc comparisons were performed with Mann-Whitney's U to determine with which balls these differences occurred. Statistical significance was set at $p\leq.05$.

Results

As shown in Table 1, the results revealed statistically significant differences for accuracy ($\chi2=1.76$, $df=2$, $p=.050$) and success ($\chi2=5.69$, $df=2$, $p=.048$). The participants obtained 0.23 more points in accuracy ($U=3490.5$, $p=.05$), and 0.17 more points in success ($U=3378$, $p=.015$) with the 440-g ball than with the 540-g ball. Accuracy and success did not undergo any statistically significant changes when comparing the data of the 440-g balls ($U=2018.5$, $p=.265$ and $U=1985$, $p=.175$, respectively) and the 540-g ball ($U=2828.5$, $p=.543$ and $U=2791.5$, $p=.405$, respectively) with the standard ball weight. Nevertheless, accuracy and success were slightly higher with the 440-g ball (0.16 and 0.10, respectively) and slightly lower with the 540-g ball (0.07 and 0.07, respectively) with regard to the standard ball weight.

Table 1. Mean, standard deviation and significant differences of the compared variables.

Variables	Ball					
	440 g		Regulation		540 g	
	M	SD	M	SD	M	SD
Accuracy*	2.23	0.99	2.07	0.98	2.00	0.91
Success*	0.54	0.50	0.44	0.50	0.37	0.48

Note: **p≤.05 to compare the 440-g with to the 540-g ball.*

Discussion

The goal of this study was to analyze whether participants can attain more free-throw accuracy and success by modifying the ball weight. The results indicated that free-throw accuracy and success were higher with the 440-g ball than with the 540-g ball. The values of these variables did not decrease statistically with the 540-g ball, nor did they increase with the 440-g ball, in comparison to the standard ball weight. These results suggest that the decrease in ball weight could be a strategy to increase free-throw accuracy and success, although perhaps the weight reduction should have been greater compared to the standard ball weight. Thus, only the differences were statistically significant when comparing the 440-g and the 540-g balls.

As ball weight increased, free-throw accuracy and success decreased. This result coincided with those of Isaacs and Karpman (1981) and Regimbal et al. (1992). They found that reduction of the ball dimensions increased accuracy. In

contrast, the results do not coincide with those of CHASE et al. (1994) and Satern et al. (1989). In their free-throw tests, they found no positive effect of the lighter ball. The difference of our study with regard to the previous ones is that we did not analyze the free throws by means of a test.

The players assessed by Isaacs and Karpman (1981) obtained a mean accuracy of 1.85 points when they used the lighter ball. Chase et al. (1994) and Regimbal et al. (1992) found that the players achieved a mean success of 0.40 points with a smaller ball and basket and of 0.49 points with a lighter ball, respectively. Success was higher with the 440-g ball compared to the results reported in the literature reviewed. This reaffirms, along with the rest of the literature consulted, the enhancing effect of the 440-g ball on accuracy and success.

It could cautiously be said that the differences in the results between the 440-g ball and the other two balls analyzed in the present study could be due to the decrease in ball weight. According to Satern et al. (1989), a lighter ball can contribute an increase of angle and release height of the ball. A decrease in speed release and an increase of angle and release height of the ball increase shot accuracy and success (BRANCAZIO, 1979; TAN; MILLER, 1980). Nevertheless, this preliminary result should be confirmed in future studies with a biomechanical approach.

Children should frequently achieve high values in accuracy and success to satisfy their preferences, have more fun and feel good (ASEP, 1996; ARIAS et al., 2009; ISAACS; KARPMAN, 1981; PALAO et al., 2004; PIÑAR, 2005; PIÑAR et al., 2007; REGIMBAL et al., 1992). In the present study, both variables increased with the 440-g ball. The fact that successful free throws increased with the 440-g ball reveals higher mastery in this game action. According to Duda (1996) and Duda and Nicholls (1992), this is one of the indicators related to motivation. A modification that allows improving this aspect is very important in such a complex sport. The predominance of these game variables may provide more enjoyable experiences for the children; in turn, they may choose to continue practicing basketball and put out more effort for a longer time.

In conclusion, the present study provides evidence of the effect of the modification of basketball weight on free-throw accuracy and success during real games in youth basketball. Accuracy and success were higher with the 440-g ball, although the differences were low in practical terms. These results support the possibility that, if an even lighter ball were used, the differences could be greater. Coaches and teachers can use lighter balls to facilitate better performance in the free throw. However, this study has several limitations: (a) only boys were studied, and (b) anthropometric characteristics, biological age, strength, and skill level were not controlled. These conditions may limit the generalization of the results and restrict them to participants with similar characteristics to those in this study.

As this is a preliminary study, future studies should analyze whether the 440-g ball can provide advantages in other variables that affect the free throw (e.g., biomechanical pattern of movement) and in other variables during the game (e.g., successful shooting, passes, bounces) to achieve some more results that may help to interpret the main results presented in the manuscript and to consolidate the results.

References

AMERICAN SPORT EDUCATION PROGRAM (ASEP). **Coaching youth basketball.** 2nd ed. Champaign, IL: Human Kinetics, 1996.

ANGUERA, M. T. La observación. In: MORENO, C. (Ed.) **Evaluación psicológica:** concepto, proceso y aplicación en las áreas del desarrollo y de la inteligencia. Madrid: Sanz y Torres, 2003. p. 271-308.

ARIAS, J. L.; ARGUDO, F. M.; ALONSO, J. I. Effect of the three-point line change on the game dynamics in girls' mini-basketball. **Research Quarterly for Exercise and Sport**, Reston, v. 80, n. 3, p. 502-509, 2009.

BRANCAZIO, P. J. Physics of basketball. **American Journal of Physics**, Huntington, v. 49, n. 4, p. 356-365, 1979. Disponível em: <http://dx.doi.org/10.1119/1.12511>. Acesso em: 05 nov. 2011.

BUNKER, D.; THORPE, R. A model for the teaching of games in the secondary school. **Bulletin of Physical Education**, Worcester, v. 10, p. 9-16, 1982.

BUTTON, C.; MACLEOD, M.; SANDERS, R.; COLEMAN, S. Examining movement variability in the basketball free-throw action at different skill levels. **Research Quarterly for Exercise and Sport**, Reston, v. 74, n. 3, p. 257-269, 2003.

CHASE, M. A.; EWING, M. E.; LIRGG, C. D.; GEORGE, T. R. The effects of equipment modification on children's self-efficacy and basketball shooting performance. **Research Quarterly for Exercise and Sport**, Reston, v. 65, n. 2, p. 159-168, 1994.

CLEARY, T. J.; ZIMMERMAN, B. J.; KEATING, T. Training physical education students to self-regulate during basketball free throw practice. **Research Quarterly for Exercise and Sport**, Reston, v. 77, n. 2, p. 251-262, 2006.

CRISCO, J.; DREWNIAK, E.; ALVAREZ, M.; SPENCINER, D. Physical and mechanical properties of various field lacrosse balls. **Journal of Applied Biomechanics**, Champaign, v. 21, n. 4, p. 383-393, 2005.

DUDA, J. L. Maximizing motivation in sport and physical education among children and adolescents: the case for greater task involvement. **Quest**, Champaign, v. 48, p. 290-302, 1996.

DUDA, J. L.; NICHOLLS, J. G. Dimensions of achievement motivation in school work and sport. **Journal of Educational Psychology**, Washington, v. 84, p.1-10, 1996.

ELLIOTT, B. A kinematic comparison of the male and female two-point and three-point jump shots in basketball. **Australian Journal of Science and Medicine in Sport**, Mitchell, v. 24, n. 4, p.111-117, 1992.

GRAWER, R.; RAINS, S. P. **Youth basketball skills and drills.** 2nd ed. Champaign: Coaches Choice Books, 2003.

HANLON, T. **Absolute beginner´s guide to coaching youth basketball**. Indianapolis: Alpha Books Que, 2005.

HOLT, N. L.; STREAN, W. B.; GARCÍA, E. Expanding the teaching games for understanding model: new avenues for future research and practice. **Journal of Teaching in Physical Education**, Champaign, v. 21, p. 132-176, 2002.

ISAACS, L. D.; KARPMAN, M. B. Factors effecting children's basketball shooting performance: a log-linear analysis. **Carnegie School of Physical Education and Human Movement**, Leeds, v. 1, p. 29-32, 1981.

JUHASZ, M.; WILSON, B. D. Effect of ball size on shooting characteristics of junior basketballers in comparison to adults. **Australian Journal of Sport Sciences**, Mitchell, v. 2, n. 2, p. 16-20, 1982.

LANDIN, D. K.; HEBERT, E. P.; FAIRWEATHER, M. The effects of variable practice on the performance of basketball skill. **Research Quarterly for Exercise and Sport**, Reston, v. 64, n. 2, p. 232-237, 1993.

LIU, S.; BURTON, A. W. Changes in basketball shooting patterns as a function of distance. **Perceptual and Motor Skill**, Missoula, v. 89, p. 831-845, 1999.

MACPHAIL, A.; KIRK, D.; GRIFFIN, L. Throwing and catching as relational skills in game play: situated learning in a modified game unit. **Journal of Teaching in Physical Education**, Champaign, v. 27, n. 1, p. 100-115, 2008.

MATHES, S.; FLATTEN, K. Performance characteristics and accuracy in perceptual discrimination of leather and synthetic basketballs. **Perceptual and Motor Skills**, Missoula, v. 55, p. 128-130, 1982.

MILLER, S.; BARTLETT, R. M. The effects of increased shooting distance in the basketball jump shot. **Journal of Sports Sciences**, Abingdon, v. 11, p. 285-293, 1993. Dispon ível em: <http://dx.doi.org/10.1080/02640419308729998>. Acesso em: 05 nov. 2011.

MILLER, S.; BARTLETT, R. The relationship between basketball shooting kinematics, distance and playing position. **Journal of Sports Sciences**, Abingdon, v. 14, p. 243-253, 1996. Disponível em: <http://dx.doi.org/10.1080/02640419608727708>. Acesso em: 05 nov. 2011.

PALAO, J. M.; ORTEGA, E.; OLMEDILLA, A. Technical and tactical preferences among basketball players in formative years. **Iberian Congress on Basketball Research**, Missoula, v. 4, p. 38-41, 2004. Disponível em: <http://dx.doi.org/10.2466/ICBR.4.38-41>. Acesso em: 05 nov. 2011.

PIÑAR, M. I. **Incidencia del cambio de un conjunto de reglas de juego sobre algunas de las variables que determinan el proceso de formación de los jugadores de minibasket (9-11 años) =** Effect of rule modifications on some of the variables that determine the formative process of mini-basketball players (9-11 year olds)]. Granada: University of Granada, 2005.

PIÑAR, M. I.; CARDENAS, D.; CONDE, J.; ALARCON, F.; TORRE, E. Satisfaction in mini-basketball players. **Iberian Congress on Basketball Research**, Missoula, v. 4, p. 122-125, 2007. Disponível em: <http://dx.doi.org/10.2466/ICbR.4.122-125>. Acesso em: 05 nov. 2011.

REGIMBAL, C.; DELLER, J.; PLIMPTON, C. Basketball size as related to children's preference, rated skill and scoring. **Perceptual and Motor Skills**, Missoula, v. 75, p. 867-872, 1992.

SATERN, M. N.; MESSIER, S. P.; KELLER-MCNULTY, S. The effects of ball size and basket height on the mechanics of the basketball free throw. **Journal of Human Movement Studies**, Edinburgh, v. 16, p. 123-137, 1989.

TAN, A.; MILLER, G. Kinematics of the free throw in basketball. **American Journal of Physics**, Huntington, v. 49, n. 6, p. 542-544, 1980. Disponível em: <http://dx.doi.org/10.1119/1.12668>. Acesso em: 05 nov. 2011.

THORPE, R. D.; BUNKER, D. J.; ALMOND, L. A change in the focus of teaching games. In: PIÉRON, M.; GRAHAM, G. (Eds.) **Sport pedagogy:** Olympic Scientific Congress proceedings. Champaign: Human Kinetics, 1984, p. 163-169.

Address:

José Luis Arias
C/ La Labor, nº 1 Jumilla
30520
Murcia España
Telefone: 0034 968278873
e-mail: jlae84@hotmail.com

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