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ABSTRACT

PURPOSE: To determine if RAEs exist in elite Olympic weightlifters from the past five Olympic Games. **METHODS**: Using retrospective competition data from the International Weightlifting Federation database a total of 953 Olympic Weightlifters (595 males and 358 females) who competed in the Olympic Games between 2000 and 2016 were included in this study. Weightlifters who competed in multiple Olympic Games were only counted once and duplicates were removed from this investigation. The weightlifters were divided into subset weight classes; men lightweight (56kg, 62kg, and 69kg), men middleweight (77kg, 85kg, and 94kg), men heavyweight (105kg and 105kg+), women lightweight (48kg, 53kg, and 58kg), women middleweight (63kg and 69kg), and women heavyweight (75kg and 75kg+). Using the subset weight classes, the observed date of birth distribution vs. the expected worldwide date of birth distribution were compared using multiple chi square (χ^2) goodness of fit tests with the alpha level set at ($p \leq 0.05$). Following up the χ^2 test, standardized residuals were calculated for each month with values of ±2 denoting significant over- and under-representation. **RESULTS**: RAEs were present overall for Olympic weightlifters ($\chi^2 = 189.428$, $p<0.001$), with significant over-representation in January (z= +12.6, 20.9%) and under-representation in June (z= -2.1, 6.3%), September (z= -3.2, 5.7%), and November (z= -3.0, 5.1%). RAEs were also present in all three male classes; men lightweight ($\chi^2 = 74.773$, $p<0.001$), men middleweight ($\chi^2 = 41.786$, $p<0.001$), and men heavyweight ($\chi^2 = 39.395$, $p<0.001$) and women lightweight ($\chi^2 = 37.251$, $p<0.001$). Significant over-representation was noted in January for men lightweight (24.1%), men middleweight (20.0%), men heavyweight (22.2%), and women lightweight (21.2%), and there was a significant under-representation for the month of November in men lightweight (z= -2.7, 2.8%). However, RAEs were not present in the women's middleweight ($\chi^2 = 18.632$, $p=0.068$) or heavyweight ($\chi^2 = 16.692$, $p= 0.117$) classes. **CONCLUSION**: In males significant RAEs are present in Olympic weightlifters regardless of weight class. However, for females RAEs only exist for lightweight Olympic weightlifters. Indicating that RAEs are present in Olympic weightlifting is important because it will help maintain the amount of opportunity for all athletes regardless of when they were born in the year. **PRACTICAL APPLICATIONS**: Coaches should be aware of the possible advantages of training age and the effect of physical maturation as a result of these RAEs. Coaches may use this information for athlete selection but the presence of RAEs should not discourage athletes from participating in the sport of weightlifting.

INTRODUCTION

- Previous studies have observed RAEs in a variety of field-based team sports[1,2].
- Literature on the presence of RAEs present in weight class sports is limited[2].
- No study has evaluated the presence of RAEs in the sport of Olympic weightlifting.

PURPOSE

- To determine if RAEs exist in elite Olympic weightlifters from the past five Olympic Games.

METHODS

Subjects

- Competition data from 953 Olympic weightlifters was used for this investigation.
- Duplicates were removed so athletes who competed in multiple Olympics were only counted once.

Statistical Analysis

- Observed birth date distribution vs. the expected worldwide birth date distribution were compared using multiple chi square (χ^2) goodness of fit tests.
- The level of significance was set at $p<0.05$.
- Standardized residuals were calculated for each month with values of ±2 denoting significance following the χ^2 tests.

RESULTS

Table 1: Observed birth date distribution (difference vs. expected frequency) amongst Male Olympic weightlifters (n = 595)

Weight Class	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	$\chi 2$	ρ
Overall	131 (78.9)	44 (-3.1)	53 (2.9)	54 (5.9)	37 (-12.1)	35 (-13.8)	47 (-4.3)	45 (-5.9)	42 (-10.1)	41 (-9.3)	23 (-24)	43 (-5.1)	144.9	<0.01
Men Lightweight	52 (33.1)	18 (0.9)	16 (-2.2)	23 (5.5)	15 (-2.8)	10 (-7.7)	17 (-1.6)	17 (-1.5)	12 (-6.9)	14 (-4.3)	6 (-11.1)	16 (-1.5)	74.8	<0.01
Men Middleweight	47 (26.4)	14 (-4.6)	22 (2.2)	19 (0)	16 (-3.4)	16 (-3.3)	21 (0.7)	14 (-6.1)	20 (-0.6)	18 (-1.9)	11 (-7.6)	17 (-2)	41.8	<0.01
Men Heavyweight	32 (19.4)	12 (0.6)	15 (2.9)	12 (0.4)	6 (-5.9)	9 (-2.8)	9 (-3.4)	14 (1.7)	10 (-2.6)	9 (-3.2)	6 (-5.4)	10 (-1.6)	39.4	<0.01

Weight Classes: Men Lightweight = 56kg, 62kg, 69kg; Men Middleweight = 77kg, 85kg, 94kg; Men Heavyweight = 105kg, 105kg+

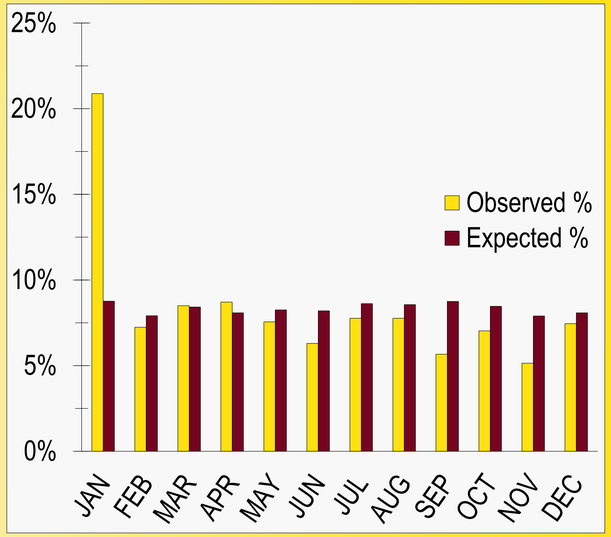
Table 2: Observed birth date distribution (difference vs. expected frequency) amongst Female Olympic weightlifters (n = 358)

Weight Class	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	$\chi 2$	ρ
Overall	68 (36.6)	25 (-3.3)	28 (-2.1)	29 (0.1)	35 (5.5)	25 (-4.4)	27 (-3.9)	29 (-1.6)	12 (-19.3)	26 (-4.3)	26 (-2.3)	28 (-0.9)	58.3	<0.01
Women Lightweight	32 (18.8)	13 (1.1)	11 (-1.7)	10 (-2.2)	15 (2.5)	9 (-3.4)	11 (-2.0)	8 (-4.9)	5 (-8.2)	11 (-1.8)	15 (3.1)	11 (-1.2)	37.3	<0.01
Women Middleweight	19 (9.6)	8 (-0.5)	9 (0.0)	7 (-1.6)	12 (3.2)	9 (0.2)	7 (-2.2)	10 (0.8)	2 (-7.4)	10 (0.9)	6 (-2.5)	8 (-0.6)	18.6	0.07
Women Heavyweight	17 (8.2)	4 (-3.9)	8 (-0.4)	12 (3.9)	8 (-0.3)	7 (-1.2)	9 (0.4)	11 (2.4)	5 (-3.8)	5 (-3.5)	5 (-2.9)	9 (0.9)	16.7	0.12

Weight Classes: Women Lightweight = 48kg, 53kg, 58kg; Women Middleweight = 63kg, 69kg; Women Heavyweight = 75kg, 75kg+

RESULTS

Figure 1: Observed vs. expected date of birth distribution of Olympic weightlifters assessed by month.



There was a significant over-representation in January (z= +12.6, 20.9%).

CONCLUSIONS

- There are significant RAEs present in male Olympic weightlifters regardless of weight class.
- RAEs are present in female Olympic weightlifters; however, only for the light weight category.

PRACTICAL APPLICATIONS

- Coaches should be aware of the possible advantages of training age and the effect of physical maturation as a result of RAEs.
- Athletes should not be discouraged from participating in weightlifting despite the presence of RAEs.

REFERENCES

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