SPORT & EXERCISE SCIENCE NEW ZEALAND

The Journal of Sport and Exercise Science, Vol. 8, Issue 1, 65-73 (2024)

www.jses.net

JSES

ISSN: 2703-240X

Youth basketball in New Zealand: Establishing performance norms in the context of 'Balance is Better'

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A R T I C L E I N F O

Received: 04.12.2023
Accepted: 04.10.2024
Online: 22.11.2024

Keywords:
Youth
Adolescent
Basketball
Normative data
New Zealand

A B S T R A C T

This study establishes normative data for adolescent basketball players in New Zealand, and seeks to understand if sport participation volumes align with the 'Balance is Better' initiative by Sport New Zealand. The study recruited a convenience sample of 55 junior representative basketball players from Hawke's Bay, New Zealand, aged 13 to 18 years, comprising 42 males and 13 females. Gender was self-reported in a baseline questionnaire that also covered sports affiliations, weekly training, game hours, and injury history. To determine physical progression through age, participants underwent anthropometric and physical performance assessments, including tests of strength endurance, power, speed, agility, and dynamic balance. Differences between age group data were assessed through one-way ANOVA and non-parametric tests. The findings indicate general adherence to 'Balance is Better' recommended activity hours across age groups. Notably, females displayed a decrease in weekly sport hours with age, contrary to male athletes. Female players also engaged more in other sports than males, suggesting less basketball specialisation, especially in the U17 category. Gender differences were evident in physical performance: females showed non-significant changes in strength endurance, jump performance, speed, and agility with age, while males exhibited significant improvements in strength endurance (press-up, $p = 0.002$; prone hold, $p = 0.002$; right side hold, $p = 0.004$; left side hold, $p = 0.005$), vertical jumps (right, $p = 0.011$; left, $p = 0.019$). It is possible that comparisons of female data were unable to detect significant differences owing to low participant numbers. The study reveals that physical performance in youth basketball in New Zealand does not uniformly improve with age. Gender disparities are evident, with females participating in varied sports and males tending towards early basketball specialisation. Overall, participation volumes align with the 'Balance is Better' guidelines.

1. Introduction

Basketball is a dynamic sport requiring strength, endurance, and speed qualities. Prior to the COVID-19 pandemic, basketball was the fastest-growing secondary school sport in New Zealand with a 45% increase in participation over the preceding decade (School Sport New Zealand, 2018). This growth continued post-pandemic, with basketball in New Zealand surpassing both Rugby Union and Football (Soccer) in overall participation numbers, second only to Netball (School Sport New Zealand, 2022). Indeed, the 2022 Secondary School Sport New Zealand Census showed a total of 25,387 adolescents played basketball that year, an increase of 62%

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since 2000 when records began (School Sport New Zealand, 2022). This participation growth has been attributed to the global popularity of basketball and increased opportunities for participation across the country, such as tournament play and three-on-three modified games (Basketball New Zealand, 2021a).

Physical performance can vary within individuals as they mature (Baxter-Jones, 2019). Cardiovascular and musculoskeletal capabilities improve with age and maturation, particularly during puberty (Mountjoy et al., 2008). However, these developments are neither linear, nor uniform across individuals. While there are datasets of physical performance and anthropometric data profiles of elite-level basketball players, there is a considerable lack of data on adolescents (Abdelkrim et al., 2010; Benis et al., 2016; Fort-Vanmeerhaeghe et al., 2016; Torres-Unda et al., 2013; Torres-Unda et al., 2016). It is therefore pertinent to collate normative data on adolescent basketball players to assess their physical performance progression as they age, and their potential progression into elite programmes. To date, there are no age group performance targets published by Basketball New Zealand, nor age group development guidelines encompassing both basketball-specific and non-basketball activities such as strength, speed, and cardiovascular development.

In addition to elite performance profiling, normative data can also be used in the management of workloads to moderate the risks of overload and overtraining (Woods et al., 2017). Periods of regional representation are particularly concerning from an overload perspective as the combination of school, community, and elite sports often forces athletes to exceed age-appropriate workload thresholds. Caution has previously been advised in this space for multiple sports (Phibbs et al., 2018; Temm et al., 2022). Thus, investigations into performance profiles of age group athletes are important not only for benchmarking, but also for the prevention of overload injuries.

‘Balance is Better’ is an initiative by Sport New Zealand to assist in creating positive sporting experiences for all New Zealand youth, to keep them active, and in sport. The initiative provides guidance on the amount of training and competition load in alignment with the World Health Organisation (WHO) and the New Zealand Ministry of Health (MoH) guidelines. Furthermore, this initiative brings into question the management of workload across multiple sports and the potential for overloading caused by early sport specialisation. ‘Balance is Better’ suggests that total sport participation hours per week should not exceed the athlete's chronological age irrespective of the number of sports played (Sport New Zealand, 2021). Basketball New Zealand, alongside other major sporting codes, signed an official statement of intent to support the principles of ‘Balance is Better’ in April 2021, with the stated aim of “supporting young people to play multiple sports and raising awareness of the risks of overtraining and overloading” (Basketball New Zealand, 2021b).

Investigations using other sports have shown considerable differences in performance profiles across age group athletes (Taylor & Lander, 2018); however, there is limited profiling of youth basketball players, particularly in New Zealand. Thus, the aim of this study was to report the physical characteristics of adolescent representative basketball players in Hawke’s Bay, New Zealand and compare their workloads with the nationally identified ‘Balance is Better’ philosophy.

2. Methods

2.1. Participants

All players from the Basketball Hawke’s Bay (BBHB) representative age group under-15 (U15), under-17 (U17), and under-19 (U19) years teams from 2020 and 2021 were invited to participate in this study. Fifty-five participants (42 males and 13 females) aged 13 to 18 years agreed to participate from a potential population of sixty-seven participants. The study was approved by the Research Ethics and Approvals Committee of Eastern Institute of Technology, New Zealand. All participants under 16 years of age obtained parental or caregiver consent.

2.2. Data collection

2.2.1. Baseline questionnaire

On arrival to the testing session, participants completed a baseline questionnaire. This questionnaire collected data on their affiliations with basketball teams, academies, and other sports teams. It also inquired about the athletes’ weekly training and game hours, along with their history of injuries. Weekly training and peak game-time hours were calculated for each participant's engagement in basketball and other sports. Total weekly physical activity hours were derived by summing basketball-related and other sports-related training and game hours.

Potential total basketball hours for secondary school training and games were derived by multiplying the weekly player training and game hours over an 18-week period, corresponding to the scheduled BBHB competition weeks (Basketball Hawke's Bay, 2020a). As secondary schools have both junior and senior national tournaments, participants indicated which they were involved in, and maximal game time was calculated on the maximum minutes per game for each of the scheduled tournaments. This prospective approach was also adopted when calculating other sports hours and Physical Education classes.

Basketball Academy training in Hawke’s Bay runs for approximately eight weeks per school term. Players reported how many terms they attended, and total academy time was calculated by multiplying the weekly training duration by the number of weeks attended (Basketball Hawke's Bay, 2020b). If players were also involved in an adult basketball club, club training and game total basketball times were calculated by the player training and game times per week over eight weeks (Basketball Hawke's Bay, 2020c). The total seasonal basketball hours were derived from the sum of all basketball-related activities per participant throughout the season.

Regional representative basketball programmes were calculated from the player training hours over 20 weeks; the number of weeks training for Easter and National tournaments. Game time was calculated on the maximum minutes per game for each of the age group related scheduled tournaments (Easter tournament [U15, U17, U19], June tournament [U19], and July tournaments [U15, U17]; Basketball Hawke's Bay, 2020d).

To create performance profiles, physical testing was conducted in February of 2020 and 2021, following the trialling and selection of all representative teams.

2.2.2. Physical performance testing

Anthropometric measurements, including arm span, leg length, height, and weight were recorded. Body mass index (BMI) was calculated using the formula:

$$BMI = \frac{Weight\ (kg)}{Height\ (m)^2}$$

Any player who disclosed a current injury was assessed by a registered physiotherapist and cleared to participate in all performance tests which were not affected by their injury. This screening resulted in no more than two athletes abstaining from various performance tests dependent upon each individual's injury.

Prior to testing, participants performed a five-minute standardised warm-up, the testing protocol then comprised of 50 minutes of physical performance testing followed by a five-minute cool-down. A rest period of at least three minutes between each physical performance test was provided for all participants.

Performance testing included a combination of strength-endurance, power, speed, agility and balance tests. The tests used have previously been shown to give an overview of the physical performance characteristics of both adolescent male and female basketball players (Drinkwater et al., 2008; Fort-Vanmeerhaeghe et al., 2016; Wen et al., 2018).

Strength endurance was assessed using prone hold, side holds and maximal press-ups. Prone and side holds required the participant to maintain postural alignment and a stable body position on toes and elbow. Participants were instructed to sustain this alignment for as long as possible; guidance was provided as required. Time to fatigue was recorded in seconds, and the test ended when the participants could no longer maintain postural alignment (Greene et al., 2012; Strand et al., 2014). The maximal press-up test required participants to perform as many full press-ups as possible. A valid repetition involved lowering the upper body to a point of 10 cm above the ground which resulted in a minimum elbow flexion of 90 degrees, as per the protocols described by Amasay et al. (2016) and Ryman Augustsson et al. (2009). The test ended if the participant failed to; maintain smooth movement without resting at any point, reach the required depth, or maintain a stable position. The total number of press-ups was recorded.

Power testing comprised of a series of vertical jumps (VJ) and broad jumps measured in centimetres. The VJ used a Swift Yardstick 2 vertical jump measurement apparatus (Swift Performance Equipment) with testing procedures identical to those described by Woolford et al. (2013). Participants stood beneath the device and extended their arm directly overhead to determine the starting point. Prior to each VJ, participants were instructed to squat to a comfortable depth and immediately jump as high as possible in one continuous motion while reaching with the designated hand, thereby using a countermovement jump and an arm swing to displace the highest vane of the Yardstick apparatus as described by Castro-Pinero et al. (2009). The performed jump was required to be from two feet with preliminary steps prohibited. The difference between the starting point and maximal height of each jump was recorded in centimetres. The test was then repeated using the opposite hand. Each jump was repeated three times with a rest between jumps for a total of six jumps; the best jump from each hand was used for data analysis. For the broad jump, participants completed three standing broad jumps from a fixed starting line. Athletes were permitted a free arm swing and self-selected countermovement jump to maximise their horizontal displacement with procedures identical to those used in Thomas et al. (2020). Participants started with their toes on a start line. The distance was recorded from the starting line to the most posterior portion of the participant's foot closest to the starting line. The furthest jump was used for data analysis.

Sprint testing was conducted over 10 metres (m) using Duo Swift laser timing system, recording 5 m and 10 m splits on the Swift SpeedLight iPad application (Version 493, Swift Performance). Sprint start position was standardised with athletes instructed to begin with their chest as close to the starting beam as possible without touching the beam with the entirety of both feet behind the starting line. The fastest of three trials was recorded for final analysis.

Agility testing used Duo Swift laser timing system, as previously described. Athletes performed a Y-shaped reactive agility test, responding to flashing light stimuli, aiming to complete the test as quickly as possible. Despite the limited transferability of time-based assessments with generic stimuli to sport-specific contexts (Young et al., 2021), time constraints necessitated the use of a generic stimulus. In this test, timing lights, activated at 5 m, randomly triggered flashing lights at either the left or right timing gates, necessitating athletes to make an unanticipated 45-degree directional change. Thus, the athletes travelled a total of 10 m with a change of direction at the 5 m mark. To distinguish the capacity for the athlete to make the directional change from sprinting speed, the agility deficit was calculated by subtracting the 0 – 10 m sprint test time from the best agility time, measured in seconds in a procedure previously described by Nimphius et al. (2013).

Dynamic balance was assessed using the Y-dynamic balance test, which encompasses anterior, posterolateral, and posteromedial directional reaches. Composite reach scores for both the right and left sides were derived using a formula previously described by Neves et al. (2017).

2.3. Statistical analysis

All data were assessed using quantile-quantile (QQ) plots for normality and Levene's test for homogeneity of variance. Residual plots and scatterplots were used to identify any potential outliers. Descriptive statistics (means and standard deviations) were calculated using Microsoft Excel to describe the data collected from each age group. Differences between the groups were determined using the Kruskal-Wallis Test for comparing three groups and Dunn's test for pairwise comparisons. When comparing between two groups the Mann-Whitney test was used. In addition, the Wilcoxon Signed-Rank test was used to determine if training time in hours exceeded chronological age of participants. All data analyses were performed using R (4.2.3).

To determine the magnitude of differences, Hedge's *g* effect sizes were calculated and reported (Bernards et al., 2017; Ellis, 2010). The size of the effect was classified as *trivial* (< 0.19), *small* (0.20 – 0.59), *moderate* (0.60 – 1.19), *large* (1.20 – 1.99), and *very large* (2.0 – 4.0; Cohen, 1988; Hopkins et al., 2009).

3. Results

Data were analysed from 55 participants, 13 females and 42 males. The average age of the female U15 and U17 cohorts was fourteen years, three months, and sixteen years, five months respectively. The anthropometric and physical activity characteristics within the groups of U15 and U17 for females are shown in Table 1 and U15, U17, and U19 for males are shown in Table 2.

All athletes met the training volume guidelines described in the Balance is Better documentation from Sport New Zealand, which recommends that weekly training hours should not exceed an athlete's chronological age in years (Sport New Zealand, 2021). A Wilcoxon signed-rank test confirmed a significant difference between age and weekly training hours ($p < 0.001$), indicating that this cohort were adhering to these guidelines (Figure 1).

Table 1: Female anthropometric and physical activity data (M ± SD).

			Hedge's *g*
	U15 (n = 7)	U17 (n = 6)	U15 vs U17
Weight (kg)	75.4 ± 15.5	72.1 ± 8.1	0.25
Height (m)	1.72 ± 0.05	1.72 ± 0.07	0.01
BMI (kg/m^2)	25.5 ± 4.2	24.3 ± 1.2	0.32
Arm span (m)	1.77 ± 0.05	1.74 ± 0.08	0.39
Basketball team/s (n)	2.4 ± 0.8	2.2 ± 0.4	0.38
Basketball training (h/week)	4.3 ± 2.9	3.5 ± 1.3	0.31
Basketball games (h/week)	1.15 ± 0.75	1.12 ± 0.55	0.04
Other sports team/s (n)	1.7 ± 1.3	1.5 ± 0.5	0.20
Other sports training (h/week)	8.9 ± 11.4	3.3 ± 3.6	0.29
Other sports games (h/week)	3.02 ± 4.7	1.25 ± 0.6	0.48
Total sport activity (h/week)	13.5 ± 9.94	9.19 ± 4.70	0.50
Total basketball activity (h/season)	181.5 ± 64.06	171.89 ± 66.79	0.14

Table 2: Male anthropometric and physical activity data (M ± SD).

				Hedge's *g*		
	U15 (n = 25)	U17 (n = 10)	U19 (n = 7)	U15 vs U17	U15 vs U19	U17 vs U19
Weight (kg)	69.2 ± 17.2	76.5 ± 7.7	82.3 ± 17.1	0.47	0.74†	0.44
Height (m)	1.79 ± 0.07	1.82 ± 0.06	1.83 ± 0.07	0.42	0.56	0.16
BMI (kg/m^2)	21.5 ± 4.8*	23.1 ± 1.7	24.4 ± 3.5	0.37	0.61†	0.47
Arm span (m)	180.8 ± 7.7	187.1 ± 7.3	185.6 ± 12.4	0.81†	0.53	0.14
Basketball team/s (n)	2.36 ± 0.6	2.5 ± 0.7	2.1 ± 1.07	0.22	0.30	0.39
Basketball training (h/week)	5.1 ± 2.4	4.2 ± 1.9	5.3 ± 2.2	0.37	0.09	0.51
Basketball games (h/week)	1.23 ± 0.33*	0.8 ± 0.28	1.14 ± 0.33**	1.32‡	0.26	1.09†
Other sports team/s (n)	0.56 ± 0.9	0.1 ± 0.3	0.14 ± 0.38	0.56	0.49	0.12
Other sports training (h/week)	0.93 ± 1.36	0.3 ± 0.95	0.57 ± 1.51	0.49	0.25	0.21
Other sports games (h/week)	1.05 ± 2.32	0.04 ± 0.2	0.12 ± 0.37	0.47	0.41	0.17
Total sport activity (h/week)	8.2 ± 4.18	5.4 ± 2.14	7.17 ± 3.39	0.74†	0.26	0.62†
Total basketball activity (h/season)	153.4 ± 39.04	191.92 ± 42.38	148.93 ± 48.94	0.94†	0.10	0.90†

Notes: *Significantly different between U15 and U17 ($p \leq 0.050$). **Significantly different between U17 and U19 ($p \leq 0.050$). †*Moderate* effect size. ‡*Large* or *Very Large* effect size.

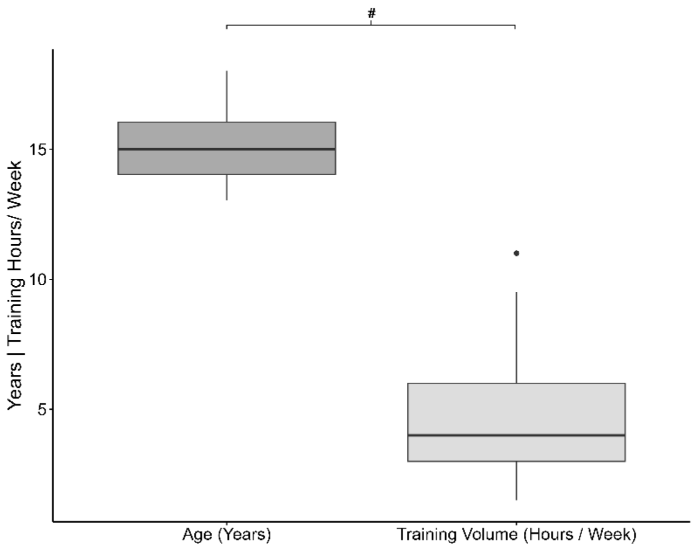

Figure 1: Difference between chronological age and weekly training hours for athletes. *Notes:* Black dot represent data points considered outliers, defined as values more than 1.5 times the interquartile range beyond the quartiles. #Significantly different ($p < 0.001$).

All participants in the U15 female age group indicated that they had sustained a previous injury at some point in their playing career, 72% of these were either the ankle or foot. The U17 age group had a previous injury rate of 67%, 50% of which were hand/wrist injuries. Across the two cohorts 42% of U15 females and 17% of U17 females indicated they were currently carrying an injury at the time of testing; however, assessment from a registered physiotherapist identified all female participants were capable of participating in testing.

In the male U15, U17, and U19 cohorts average ages were fourteen years, three months; sixteen years, five months; and seventeen years, seven months, respectively. Previous injuries were identified by 52%, 70%, and 57% of participants in respective age groups. The predominant area the ankle or foot for all age groups, (86%, 86%, and 100%, respectively). Fewer current injuries were indicated by males compared to female athletes, for males these were 8% for U15, 30% for U17, and 14% for U19 age groups. Eighty three percent of current injuries within these groups were lower limb injuries. Two players were identified by the physiotherapist as unfit to complete some components of the physical performance testing (dynamic balance, jumping, press-up, speed, and agility) due to ankle injury.

Comparative data from the female and male U15 and U17 age group physical activities are shown in Table 3. There is a *large* difference in the number of other sporting teams that female athletes are engaged in compared to males in the U15 ($g = 1.13$), this difference is greater in the U17 age group ($g = 3.21$). Despite this, the average weekly total sport hours reduced in females as they aged, by contrast, males' average weekly total sport hours reduced at U17 and then increased in the U19 age group. The female athletes profiled appear to engage in other sports alongside basketball over all age groups while males do not, which may suggest early specialisation of basketball in the U15, U17, and U19 age groups is more prevalent in males than females.

Table 3: Female vs Male age group comparisons for physical activity data (M ± SD).

	U15			U17		
	Female (n = 7)	Male (n = 25)	Hedge's g	Female (n = 6)	Male (n = 10)	Hedge's g
Basketball team/s (n)	2.4 ± 0.8	2.36 ± 0.6	0.11	2.2 ± 0.4	2.5 ± 0.7	0.51
Basketball training (h/week)	4.3 ± 2.9	5.1 ± 2.4	0.30	3.5 ± 1.3	4.2 ± 1.9	0.39
Basketball games (h/week)	1.15 ± 0.75	1.23 ± 0.33	0.19	1.12 ± 0.55	0.8 ± 0.28	0.74†
Other sports team/s (n)	1.7 ± 1.3*	0.56 ± 0.9	1.13†	1.5 ± 0.5*	0.1 ± 0.3	3.20‡
Other sports training (h/week)	8.9 ± 11.4*	0.93 ± 1.36	1.25‡	3.3 ± 3.6*	0.3 ± 0.95	1.25‡
Other sports games (h/week)	3.02 ± 4.7*	1.05 ± 2.32	0.65†	1.25 ± 0.6*	0.04 ± 0.2	2.44‡
Total sport activity (h/week)	13.5 ± 9.94	8.2 ± 4.18	0.89†	9.19 ± 4.70*	5.4 ± 2.14	1.09†
Total basketball (h/season)	181.5 ± 64.06	153.4 ± 39.04	0.61†	171.89 ± 66.79	191.92 ± 42.38	0.36

Notes: *Significantly different ($p \leq 0.05$). †*Moderate* effect size. ‡*Large* or *Very large* effect size.

Female age group physical performance characteristics are outlined in Table 4, with no significant differences between the age groups. It should be noted that while mean strength characteristics increased with age, there was a reduction in the mean VJ and broad jump with increasing age, along with poorer speed and agility times as athletes moved age groups.

Male age group physical performance characteristics show significant differences between the U15 and U17 groups in all strength endurance tests (prone hold and press-up, both p's = 0.002) and VJs (right, $p = 0.011$; left, $p = 0.019$). Significant differences were also shown between the U15 and U19 in press-ups ($p = 0.005$) and VJs (right, $p = 0.003$; left, $p = 0.001$); however, there were no differences between and of the physical performance measures in the U17 and U19 cohorts. Table 5 outlines the male physical performance characteristics. Of potential concern for the female U17 group is the difference in the right and left side anterior direction dynamic balance, with bilateral differences approaching 4 cm (75 cm vs 78.8 cm) since a difference of 4cm or greater is suggested by Neves et al. (2017) to elicit a greater probability of lower limb injury; however, it should be noted these values failed to reach significance (right, $p = 0.475$; left, $p = 0.317$).

Table 4: Female age group physical testing characteristics (*M* ± SD).

			Hedge's *g*
	U15 (*n* = 7)	U17 (*n* = 6)	U15 vs U17
Dynamic balance R composite (%)	87.6 ± 12.4	95.1 ± 19.1	0.44
Dynamic balance L composite (%)	88.9 ± 12.0	95.5 ± 19.6	0.39
Prone hold (s)	51.3 ± 11.3	73.1 ± 62.1	0.47
R side hold (s)	26.1 ± 9.04	47.1 ± 20.9	1.25‡
L side hold (s)	29.3 ± 14.5	47.8 ± 20.7	0.98†
Press-up (n)	8.3 ± 6.7	11.5 ± 9.0	0.38
Broad jump (cm)	179.7 ± 14.5	174.6 ± 30.6	0.53
VJ R (cm)	47.9 ± 6.8	47.3 ± 7.4	0.07
VJ L (cm)	44.0 ± 5.1	41.5 ± 3.7	0.51
Speed 0 – 5m (s)	1.30 ± 0.07	1.32 ± 0.07	0.29
Speed 0 – 10m (s)	2.2 ± 0.09	2.23 ± 0.11	0.46
Agility (s)	3.18 ± 0.3	3.33 ± 0.2	0.55
Agility deficit (s)	1.0 ± 0.26	1.1 ± 0.18	0.41

Notes: VJ = vertical jump; R = right; L = left. No significant differences between U15 and U17 groups ($p > 0.050$). †*Moderate* effect size. ‡*Large* or *Very large* effect size.

Table 5: Male age group physical testing characteristics (*M* ± SD).

				Hedge's *g*		
	U15 (*n* = 25)	U17 (*n* = 10)	U19 (*n* = 7)	U15 vs U17	U15 vs U19	U17 vs U19
Dynamic balance R composite (%)	93.12 ± 15.67	82.21 ± 8.74	90.32 ± 10.04 $^{n-1}$	0.76†	0.18	0.83†
Dynamic balance L composite (%)	92.95 ± 16.01 $^{n-2}$	86.75 ± 10.90	89.17 ± 10.37	0.41	0.25	0.21
Prone hold (s)	71.65 ± 32.30 *	119 ± 57.70**	116.86 ± 87.65	1.13†	0.91†	0.03
R side hold (s)	37.35 ± 21.82 *	63.2 ± 24.38**	60.43 ± 32.32	1.12†	0.93†	0.09
L side hold (s)	39.67 ± 22.30 *	64.3 ± 22.83	52.14 ± 24.55	1.07†	0.53	0.49
Press-up (n)	19.8 ± 9.01 *	30.2 ± 8.31**	34.5 ± 17.12 $^{n-1}$	1.15†	1.32‡	0.33
Broad jump (cm)	202.16 ± 21.51	214.48 ± 12.83	218.50 ± 27.18 $^{n-2}$	0.62†	0.71†	0.20
VJ R (cm)	50.08 ± 8.44 *	58.11 ± 8.37** $^{n-1}$	61.0 ± 5.51 $^{n-1}$	0.93†	1.33‡	0.37
VJ L (cm)	47.6 ± 9.38 *	54.56 ± 6.52** $^{n-1}$	58.5 ± 3.45 $^{n-1}$	0.78†	1.23‡	0.67†
Speed 0-5m (s)	1.18 ± 0.09 $^{n-1}$	1.14 ± 0.06	1.19 ± 0.08 $^{n-1}$	0.53	0.05	0.70†
Speed 0-10m (s)	2.00 ± 0.12 $^{n-1}$	1.92 ± 0.06	1.99 ± 0.14 $^{n-1}$	0.71†	0.03	0.71†
Agility (s)	2.93 ± 0.21	2.95 ± 0.21	2.96 ± 0.08 $^{n-1}$	0.10	0.17	0.07
Agility deficit (s)	0.93 ± 0.19 $^{n-1}$	1.03 ± 0.20	0.97 ± 0.15 $^{n-1}$	0.50	0.20	0.31

Notes: VJ = vertical jump; R = right; L = left. *Significant differences between U15 and U17 groups ($p < 0.050$). *Significant differences between U17 and U19 groups ($p < 0.050$). †*Moderate* effect size. ‡*Large* or *Very large* effect size. $^{n-1}$ Less one participant. $^{n-2}$ Less two participants.

4. Discussion

In New Zealand and globally, many sports have focused on understanding athletes' physical development and performance as they mature and advance in their respective sports. Such profiling can provide objective data for talent identification and development (Woods et al., 2017). However, at present, Basketball New Zealand has not published age group performance targets, nor age group development guidelines for basketball-specific and non-basketball activities. To our knowledge, this is the first study in New Zealand to describe the physical characteristics of adolescent representative basketball players in New Zealand and compare their workloads with the national ‘Balance is Better’ philosophy.

One might presume that physical performance increases linearly with age. However, chronological age does not necessarily align with biological maturity nor reflect the accumulation of training and competitive sport experience (Salles et al., 2019). In this study, whilst some of the female physical performance results such as dynamic balance and strength endurance (core and press-up) increased from the U15 to U17 age groups, other physical performance tests such as jump (VJ and broad), speed and agility reduced with age. Notably, except for the prone hold, none of the measures showed significant changes between age groups. For males, improvements were observed in prone hold, side holds from both sides, press-ups, and VJ from U15 to U17. Significant differences between U17 and U19 were seen in prone holds, right-side holds, press-ups, and VJ on both sides. Of note, there was a non-significant reduction in performance of the U19 age group in dynamic balance, speed and agility.

Using data from a similar Netball study in New Zealand this study would suggest that basketball participants are taller and heavier with a greater BMI than netballers (Taylor & Lander, 2018), despite this, when comparing right and left VJ females from the basketball study appeared to jump approximately 15 cm higher than netballers. These differences may reflect sport-specific differences between netball and basketball.

While players, parents, coaches, and sporting organisations should all be aware of performance profile results, it is important to acknowledge that these are a snapshot in time and should not be assumed to increase linearly. Age group comparisons of teams as a collective do not take into consideration individualised biological age markers such as the timing of peak height velocity, and thus we should apply group data to individuals with caution. Additionally, the literature offers limited data on talent identification in basketball (Barraclough et al., 2022). Although derived from a small cohort, this study enhances the understanding of performance profiles in New Zealand basketball.

Research indicates that early sport specialisation may expose children to higher risks of burnout and overuse injuries (Jones & Chang, 2021). Therefore, it is important that youth are provided environments where they can engage in multiple sports, aligning with the 'Balance is Better’ campaign. In contrast, talent identification pathways typically focus on identifying athletes at an early age and nurturing them exclusively within a single sport (Larkin & Reeves, 2018). This approach contradicts the multi-sport participation philosophy of 'Balance is Better’. The ‘Balance is Better’ campaign, developed by Sport New Zealand, advises coaches, parents, and leaders to encourage diverse sports participation among young people while monitoring participation time. A key guideline suggests aligning weekly participation hours with the child's chronological age (https://balanceisbetter.org.nz/a-practical-guide-for-monitoring-athlete-training-and-competition-load/). This study, and others (Standing et al., 2019), would suggest that chronological and biological age are both important maturation metrics to consider for regulating workload.

The data from this research suggests that New Zealand youth basketballers athletes are broadly following the participation ‘Balance is Better' workload guidelines. This is notable given the typical categorisation of basketball as an early specialisation sport (Baker et al., 2019). Despite this, the data suggests a balanced workload among these athletes, aligning with data from High Performance Sport New Zealand, which indicates that athletes generally specialise in their respective sports at 15 years and 5 months (High Performance Sport New Zealand, 2020). Interestingly, the data revealed a gender disparity, showing that male athletes tend to focus exclusively on basketball earlier than female athletes.

Limitations

This study has some limitations that should be considered in future research. First, the dataset used was small and profiled a single region of New Zealand; more research is needed to determine if the findings align with the wider New Zealand youth basketball population. Second, our methods used chronological age as a primary measure; future research should consider indicators of biological age such as the peak height velocity to better understand athlete development on a biological maturation level as well as chronological age (Till et al., 2018).

Conclusion

The aim of this study was to report the physical characteristics of adolescent representative basketball players in Hawke’s Bay, New Zealand, and to compare their workloads with the nationally endorsed ‘Balance is Better’ philosophy. The results are positive, indicating that athletes generally adhere to the recommended participation hours. The study also suggests that male athletes specialise earlier than female athletes, whilst females appear to maintain representation on a range of teams across other sports. However, this observation should be considered in the context of the limited size of the cohort, variable training opportunities, and notable decline in female total sport activity in hours per week. Despite these limitations and its focus on a single region, the study provides a foundation for future research to develop more generalisable guidelines that support the well-being and development of junior basketballers.

Conflict of Interest

The authors declare no conflict of interests.

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