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Exploring Australian high-performance athletes' perceptions and experiences of sport participation during pregnancy and post-pregnancy: Development and test-retest reliability of the Mum-Alete Survey.

ABSTRACT

Objectives

To develop and assess the test-retest reliability of a survey exploring high-performance athletes' perceptions and experiences during and post-pregnancy.

Design

Cross-sectional mixed-methods survey.

Methods

A three-phase approach was employed to develop the Mum-Alete survey. Relevant domains and questions were identified through a review of the literature and gap analysis (Phase 1). The face and content validity were assessed during Phase 2. The survey was modified, and the final survey included 113 questions. The test-retest reliability was assessed during Phase 3. Seven athletes aged ≥18 years who were currently pregnant and/or given birth since 1 July 2016 were recruited. The survey was administered via Qualtrics and completed on two occasions. Intraclass correlation coefficient (ICC) were determined to assess test-retest reliability (excellent, good, moderate, and poor).

Results

The average ICC of all items was 0.962 (95% CI 0.957-0.966) demonstrating excellent test-retest reliability. The test-retest reliability was excellent for the demographic and general questions domain (ICC = 0.967 95% CI 0.955-0.977) and good for the exercise (ICC 0.762 95% CI 0.707-0.811), physical health (ICC 0.841 95% CI 0.810-0.868) and well-being (ICC 0.827 95% CI 0.784-0.865) domains.

Conclusions

The high test-retest reliability of the survey indicates excellent consistency of measures between the two time-points.

1. **INTRODUCTION**

In recent years women's sport has experienced significant growth in both participation and professionalisation across the globe (Fryer, 2021; International Paralympic Committee, 2021). As a result, more women compete in high-performance sports and for longer. Forty-nine percent of athletes (all nations) competing at the 2020 Olympics were female compared to 45% in 2016 (Fryer, 2021). There was also an 11% increase of female Paralympians for the 2020 Paralympics (1,853 athletes compared to 1,671 in Rio 2016), highlighting an increase in elite female sport participation worldwide (International Paralympic Committee, 2021). Increased popularity of women's sport over the past decade is reflected by an increase in media coverage. For example, the 2019 Fédération Internationale de Football Association (FIFA) Women's World Cup Final in France was the most watched match in Women's World Cup history, with 82 million people worldwide tuning in live (FIFA, 2021). The 2020 International Cricket Council Women's Twenty20 World Cup Final held in Australia attracted over 86,000 spectators on International Women's Day, the largest attendance for a live women's sport event this millennium (International Cricket Council, 2021).

Historically, many female athletes delayed motherhood until the end of their sporting careers. However, pregnancy is now less likely to mark the end of an athlete's career, with an increased number of athletes becoming pregnant, and continuing to compete during pregnancy and/or returning to high-performance sport as mothers (Carver-Dias, 2010; Solli & Sandbakk, 2018; Sundgot-Borgen, Sundgot-Borgen, Myklebust, Solvberg & Torstveit, 2019). Importantly, athletes who have returned to sport post-pregnancy have gone on to break personal and world records, demonstrating that pregnancy does not necessarily prevent return to peak performance (Chicago Tribune, 2021; Jupp, 2021; Solli & Sandbakk, 2018). Despite the aforementioned triumphs, the limited available literature suggests female athletes who return to sport as new mothers face many barriers including poor sleep and lack of support (Edie et al., 2021). The qualification requirements for major events may also be a barrier faced by mothers. For instance, Canadian boxer Mandy Bujold was ineligible to compete in the 2020 Olympics because she was pregnant, thus absent from the sport during the International Olympic Committee (IOC) qualification period. She appealed to the Court of Arbitration for Sport (CAS) against the IOC's

qualification process and won her appeal to compete. Further, the CAS ruled that the IOC's boxing task force must include an accommodation for women who were pregnant or postpartum during the qualifying period; a decision that will impact the future of women's sport (Canadian Broadcasting Corporation, 2021). After Canadian basketball player Kim Gaucher appealed to the IOC to bring her breastfed daughter amid pandemic restrictions to the Olympic village, the Tokyo organisers later allowed all nursing mothers to bring their children after increased international pressure (Karstens-Smith, 2021; Thornton & Davenport, 2021). Despite their personal achievements, top female athletes like Allyson Felix, Alysia Montaño and Kim Gaucher have also experienced pay cuts and unfair discriminatory changes to their sponsorship contracts upon announcing their pregnancy (Felix, 2022; Montaño, 2022). Sport policies, structures and procedures need to evolve to support the health and well-being of athletes who train and compete during and post-pregnancy.

Despite increased interest in women's sport, research into returning to high-performance sport post-pregnancy is limited. A recent systematic review and meta-analysis evaluating foetal and maternal pregnancy outcomes found a lower prevalence of pregnancy-related back pain in high-performance athletes who had participated in competitive sport immediately prior to conception, compared with those who did not. However, competing in high-performance sport pre-conception does not have the same protective effect for pelvic girdle pain as it appears to for low-back pain (Wowdzia, McHugh, Thornton, Sivak, Mottola & Davenport, 2021). Another systematic review and meta-analysis found a higher rate of return to sport before six weeks post-pregnancy and a higher number of injuries (e.g., stress fractures) amongst high-performance athletes compared to those who did not participate in high-performance sport (Kimber et al., 2021). Limited data prevented the authors from assessing whether an earlier return to sport post-pregnancy is linked to increased risk of injury or altered sport performance post-pregnancy (Kimber et al., 2021). As reported by the authors, the findings from both meta-analyses were based on 'low' and/or 'very low' certainty of evidence, and there is no data available for Australian high-performance female athletes (Kimber et al., 2021; Wowdzia et al., 2021). High-quality research is therefore needed to inform evidence-based strategies and policies for optimal maternal and foetal outcomes as well as safe and timely return to high-performance sport.

Our current understanding of high-performance athlete experiences of training and competing during this unique time of their athletic careers is limited. A recent qualitative study explored experiences of elite athletes and pregnancy through a semi-structured interview revealing five important themes (1. pregnancy planning and fertility, 2. pregnancy disclosure and discrimination, 3. training and pregnancy athletic bodies, 4. safety concerns and supportive network, and 5. equitable funding) (Davenport, Nesdoly, Ray, Thornton, Khurana & McHugh, 2022). This study highlighted the importance of the athlete voice in identifying challenges faced by athletes during the various stages of pregnancy, allowing governing sporting organisations to develop policies to better support these athletes (Davenport et al., 2022). A recent mixed methods survey explored the experiences and perceptions related to training, problems and complications during pregnancy, injuries, eating disorders and practical experiences related to motherhood (Sundgot-Borgen et al., 2019). The 34 Norwegian high-performance athletes and 34 active controls surveyed reported decreased training volumes during all trimesters and the first two postpartum periods compared to pre-pregnancy. However, 71% of high-performance athletes returned to sport/exercise at 0-6 weeks postpartum compared to 32% of controls. Most athletes were unsatisfied with advice received relating to nutrition (82%) and strength training (53%) during pregnancy. Further, athletes reported higher drive for thinness scores, but fewer met the criteria for eating disorders postpartum compared to pre-pregnancy and pregnancy. Athletes' experiences of pregnancy and continued high-performance sport participation and/or return to high-performance sport post-pregnancy is complex. Data from the Norwegian or North American studies cannot necessarily be extrapolated into the Australian high-performance system owing to cultural as well as context specific aspects such as parental leave (Australian Government, 2010; Brandth & Kvande, 2018) and high-performance system structure (May, 2021; Skille & Säfvenbom, 2011). Therefore, our study outlines the development and test-retest reliability assessment of a survey (i.e., the Mum-Alete survey) exploring Australian high-performance athletes' perceptions and experiences during and post-pregnancy. This research is in line with a policy imperative set out in the Australian Institute of Sport (AIS) National High-Performance Strategy with the view to nationally implement findings across the high-performance system through the AIS Female Performance and Health Initiative (FPHI).

2. **METHODS**

The research team consisted of three Sport and Exercise Medicine Physicians (one of whom is also an Olympian), two researchers with expertise in female athletes, a Sport and Exercise Medicine Registrar and a dual Olympian who is undertaking a medical degree as the athlete research partner. The current athlete research partner (HB) assisted with the planning, design and conduct of this study to ensure that the 'athlete voice' was represented and that the Mum-Alete survey instrument was relevant. Following research team discussion, it was decided that at a practical level, a cross-sectional survey instrument is the most efficient means of gathering information about Australian high-performance athletes' perceptions and experiences during and post-pregnancy. This research was approved by the AIS Ethics Committee (Approval number: 20210501). This study is reported according to the 2011 Guidelines for Reporting Reliability and Agreement Studies (GRRAS) (Kottner, Audige, Brorson, Donner, Gajewski, Hrobjartsson et al., 2011) (Appendix A).

2.1 Study design

A survey allowed us to collect baseline data to guide further qualitative research such as focus groups and semi-structured interviews. Additionally, from a practical perspective, a survey could be easily distributed and accessed (particularly during the current COVID-19 pandemic) and is cost-effective and time efficient in the context of competing commitments of athletes and their wide geographical footprint. Poorly designed survey questions are the main cause of non-sampling error, which can also influence the response rate, the quality of responses and consequently the conclusions drawn from the results. Therefore, we used a structured three phase process (Figure 1) and followed best practice in survey development (Boparai, Singh & Kathuria, 2018; Rattray & Jones, 2007). During the survey design, we considered the possible scenarios needing exploration (Figure 2) to ensure the survey questions reflected all possible construct domains (content validity), the appropriateness of data items to collect accurate information and coding of responses to assist with data analysis.

< Insert Figure 1. Diagram depicting the development and reliability testing process of the Mum-Alete Survey>

< Insert Figure 2 - possible scenarios explored in the Mum-Alete survey. >

Phase 1 of survey development involved a comprehensive review of the literature followed by a gap analysis to identify relevant domains and questions for inclusion in the Mum-Alete survey. At the time of study commencement, the survey instrument used in the Sundgot-Borgen et al (2019) study was the only survey available worldwide that explicitly explored the experiences of elite athletes during pregnancy and post-pregnancy. Upon request, the lead author of that study (JSB), who is also a member of the Mum-Alete research team, translated the survey from Norwegian to English, which was used to inform the development of the Mum-Alete survey. Questions suitable for the Australian high-performance sport environment were identified from the survey. Further survey questions that were deemed appropriate were developed by the multidisciplinary research team.

We used a mixed methods approach, utilising both open and closed-ended questions to explore in detail the possible scenarios illustrated in Figure 2 to gain greater insight and nuance understanding of an athletes' experience during and post-pregnancy. Specifically, closed multiple-choice questions consisted of the most likely responses and 'other' option was used to lower cognitive load on the respondents as well as for ease of coding and data analysis. For example, participants were asked 'does your sporting organisation have a pregnancy policy?', with available responses of 'yes', 'no', or 'unsure'. To gain in-depth understanding of individual experiences of the complexities of training and competing during pregnancy and/or returning to high-performance sport post-pregnancy, we included open ended questions to allow respondents to answer the question in their own words. For example, if participants selected 'yes' or 'unsure' when asked whether pregnancy had affected their performance, a follow-up question of 'how has pregnancy affected your performance?' was asked. Other questions within the survey utilised a 5-point Likert scale. For example, when asked 'how would you describe the attitudes of others regarding your decision to continue high-performance training during pregnancy',

participants could select from 'very unsupportive, 'unsupportive', 'neutral', 'supportive' and 'very supportive' for partner, family/ friends, coaching staff, teammates/fellow athletes, sporting organisation and medical staff. We utilised skip logic within the survey to reduce participant burden and collect rich data where appropriate based on participant responses.

The final pool included 395 questions covering four domains: (a) demographic and general questions about pregnancy; (b) exercise during and post-pregnancy; (c) physical health (injuries, pregnancy complications) and (d) well-being (mental health, financial, social). We used the possible scenarios illustrated in Figure 2 to ensure that the questions included in the first draft survey represent all aspects of the domains, whilst reducing the responder burden by further prioritising 155 questions. The survey instrument was then divided into two streams (pregnancy and post-pregnancy) to capture data relevant to the stage of pregnancy/post-pregnancy of the participant.

Phase 2 involved ensuring content and face validity of the Mum-Alete survey instrument. Content validity assesses the adequacy or the representativeness of all aspects of a construct domain. Content validity is a qualitative form of validity and is guided by judgement if all the items included in the Mum-Alete survey adequately represent all the domains of the concept being explored. One of the methods to assess content validity is through expert opinion. Face validity is the degree to which a procedure appears effective in terms of its stated aims. Face validity is also a qualitative type of validity. In the context of survey research, a small group of people with relevant expertise provide comment on the survey's ability to align with the aims of the project and if the survey instrument covers all relevant constructs it set out to measure. The draft survey was therefore sent to two stakeholders who were former female athletes with experience in high-performance sport administration, coaching and research. Feedback was obtained on ease of use, length, readability, content, scenarios/constructs explored (Figure 2) and suggestions for any alterations, additions, and omissions. In addition, the survey questions were externally peer reviewed for content and face validity by the AIS Research Review Committee which included a statistician, a Professor of Sports Medicine and former Editor-in-Chief of a sports medicine journal and a Sport Scientist with over 25 years of experience. All feedback received

was considered and the survey was modified as required. Co-creation of the Mum-Alete survey with key stakeholder groups including athletes can enhance the content and face validity of the survey. Following an iterative process, the final Mum-Alete survey included 51 questions in the pregnancy stream and 62 questions in the post-pregnancy stream (Appendix B).

Phase 3 involved assessment of the test-retest reliability of the Mum-Alete survey. In this manuscript test-retest reliability represents the consistency of outcome measures over time. It was assumed that the outcome measures assessed did not change for participants between the two time points. The objective of this study is to provide information on the internal consistency (using intra-class coefficient) of the Mum-Alete survey.

2.2 Study participants

Australian high-performance female athletes aged ≥18 years and have represented their sport at the State/ Territory, National or International level, who are currently pregnant and/or given birth since 1 July 2016 were eligible to participate in Phase 3 of this study. Further, they needed to have been training and/or competing at a high-performance level within the six months prior to their pregnancy.

A small sample size is usually required for estimation of intraclass correlation coefficient (ICC) (Tan et al., 2013). Given two completions of each questionnaire by the participants were used to assess the test-retest reliability, the minimum number of samples required to detect an ICC value of 0.8 was seven (power = 80%) (Tan et al., 2013). Therefore, a generic email with the plain language statement was sent to National Sporting Organisations (NSO's) and Chief Medical Officers within professional sport requesting them to distribute it to athletes who met the above inclusion criteria. Interested athletes were instructed to contact the lead researcher (VF). Upon contact, athletes were assessed for eligibility. Eligible participants were then provided with a study information sheet and any questions were answered before agreeing to participate.

2.3 Data collection

If the athletes indicated that they were interested in taking part, the lead researcher (VF) then emailed them a unique link to the Mum-Alete survey via Qualtrics^{XM} online survey platform, which was active for 14 days. To assess the test-rest reliability, a second unique link was emailed to the participants 28 days after they completed the first survey, which was also active for 14 days. A reminder email was sent to participants to complete the survey 7 days after each survey link was sent if they had not yet completed it. The Mum-Alete survey took approximately 20-25 minutes to complete, depending on individual responses. All athletes who took part completed the survey independently on both occasions.

2.4 Data analysis

Data were extracted from Qualtrics^{XM} online survey platform de-identified and analysed using statistical package for social science (IBM® SPSS®) v 19 software. Consistency between first and second responses were compared using the ICC (Ormeus, Ormeus, Hall, McKinnon & ECT and Cognition Systematic Review Team, 2012; Weir, 2005). A two-way mixed model with absolute agreement was used to calculate the ICC (Weir, 2005). The following definitions were used to aid interpretation of results: *ICC values*: < 0.5 = poor; 0.50-0.75 = moderate; 0.75-0.90 = good; >0.90 = excellent (Koo & Li, 2016).

3. RESULTS

Seven female athletes completed the Mum-Alete survey on two occasions, on average 32 days (SD 4) apart. The mean age was 33 years (SD 6) with 71% of participants either married or in a de facto relationship. Majority (71%) of athletes participated in team sports. All athletes have competed at a State/Territory or National level in their chosen sport/s with six athletes (86%) having competed at the international level.

The average ICC of all items was 0.962 (95% CI 0.957 - 0.966, *p*<0.001) demonstrating excellent consistency of measures across the two time points. We analysed the ICC for the four survey domains. The demographic and general questions about pregnancy had an excellent test-retest reliability (ICC =

0.967, 95% CI 0.955 – 0.977 p <0.001). The ICC for exercise undertaken during and post-pregnancy was 0.762 (95% CI 0.707 – 0.811 p <0.001), indicating good test-retest reliability. Although the Likert-scale responses for 10 items did not match for this domain, the response sentiment and direction remained the same. For example, some participants selected 'very satisfied' in the first survey but then selected 'satisfied' in the second survey. The consistency of measures for physical health (injuries, pregnancy complications) was good with an ICC of 0.841 (95% CI 0.810 – 0.868, p <0.001). Although the Likert-scale responses for 21 items did not match for this domain, the response sentiment and direction remained the same. The ICC for well-being (mental health, financial and social) was 0.827 (95% CI 0.784 – 0.865 p <0.001) demonstrating good test-retest reliability. The Likert-scale responses for 27 items did not match for this domain but the response sentiment and direction remained the same.

4. DISCUSSION

The main finding of this study was that the test-retest reliability of the Mum-Alete survey was high with an excellent consistency of measures between the two time points (average ICC 0.962) indicating excellent temporal stability. Therefore, the Mum-Alete survey is a reliable tool for Australian high-performance female athletes to collect accurate self-reported data on perceptions and experiences during and post-pregnancy.

In recent years, patient and public involvement activities in research is considered best practice and an ethical imperative to improving the quality, safety, value, and sustainability of health systems and medical research (Richards, 2022). The athlete is the central focus in sports medicine research. Athletes lived experiences make them 'knowledge experts', however, athlete 'voice' or perspectives are not commonly incorporated in sport medicine research. The AIS actively encourages involvement of athletes and stakeholders as co-creators of research to promote relevance, holistic coverage and ecological validity (Richards, 2022). Therefore, we engaged key stakeholder groups with diverse perspectives and expertise, including former athletes, policy makers, sports administrators, a statistician, a Professor of Sport Medicine and former Editor-in-Chief of a sports medicine journal and a Sport Scientist to provide meaningful contributions to the study. We embedded an athlete research

partner (HB, a dual Olympian) within the research team, where she, actively worked in partnership with the research team to plan, design and conduct this study, and has contributed to improvements in quality and relevance of our study. Co-creation of the Mum-Alete survey 'with' the key stakeholder groups rather than 'to' or 'from' them also contribute to establishing an appropriate degree of content and face validity of the survey and have led to excellent internal consistency of survey questions.

The test-retest reliability was excellent for demographic and general questions about pregnancy (ICC 0.967), possibly because these questions were less likely to be misinterpreted or subject to recall bias. However, the test-retest reliability was slightly lower for survey questions exploring exercise during pregnancy and post-pregnancy (ICC 0.762), physical health (ICC 0.841) and well-being (ICC 0.827). There is no universal consensus for how the magnitude of the ICC should be interpreted; Fleiss (as cited in Ormeus et al, 2012) proposed a classification for the strength of test-retest reliability based on the ICC values as follows: *< 0.40 poor, 0.40–0.75 fair to good and > 0.75 excellent*. However, we used the definitions set by Koo and Li (2016) based on ICC values as follows: *< 0.5 = poor; 0.50-0.75 = moderate; 0.75-0.90 = good; >0.90 = excellent* to interpret results. The lower test-retest reliability of the questions exploring 1. exercise during pregnancy and post-pregnancy, 2. physical health and 3. wellbeing, could be due to effects of response bias as the study participants were asked to offer self-assessed measures of a phenomenon (e.g., How satisfied are you with exercise advice? with possible response choices: very unsatisfied, unsatisfied, neutral, satisfied, very satisfied). Ten Likert-scale responses in the exercise domain, 21 in the physical domain and 27 in the well-being domain did not match, however the sentiment was in the same direction (i.e., satisfied and very satisfied), which has affected the ICC for these domains. To reduce response bias, we used neutrally worded short and clear questions, non-leading questions and five-point satisfaction rating scales ranging from very unsatisfied to very satisfied. Athlete circumstances may also have changed between the survey time-points; for example, new pregnancy or different trimester of pregnancy, which may have affected consistency of responses of questions influenced by the different stages of pregnancy or post-pregnancy, thereby affecting the ICCs.

Compared to the other domains, the test-retest reliability of questions exploring exercise during pregnancy and post-pregnancy, had the lowest consistency of measures (ICC 0.762). It is possible that the questions included in this domain are more likely to be subject to recall bias as study participants may erroneously provide responses that depend on their ability to recall past events (e.g., What type of training have you been able to participate in (e.g., endurance training? 1st trimester – yes/no/N/A, 2nd trimester – yes/no/N/A, 3rd trimester – yes/no/N/A). The type of training may change regularly and significantly because of the physical and physiological changes occurring in the different stages of pregnancy. Hormonal changes, sleep deprivation, stress, or brain changes occurring during pregnancy can impair memory among pregnant women (Davies, Lum, Skouteris, Byrne & Hayden, 2018). Where appropriate, a simple, short, and concise set of answer options were provided to reduce the risk of recall bias. It should be noted that in addition to the face validity of the survey, we did not pursue other forms of validity (construct, criterion), which might be a limitation. It is important to note that the purpose of the Mum-Alete survey is to capture experiences of Australian high-performance athletes during pregnancy, and post-pregnancy and the overall test-retest reliability was excellent, thus no survey questions were modified after the pilot study.

5. <u>CONCLUSION</u>

The Mum-Alete survey was co-created 'with' the active involvement of athletes and other key stakeholder groups to promote relevance, holistic coverage and ecological validity of the data. The test-retest reliability of the survey was high with an excellent consistency of measures between the two time points. Therefore, the Mum-Alete survey can be utilised to collect accurate self-reported data on perceptions and experiences during and post-pregnancy from Australian high-performance female athletes.

6. <u>PRACTICAL IMPLICATIONS</u>

- The Mum-Alete survey will be the first to collect this data among Australian high-performance athletes therefore providing valuable insight into the athletes' experiences during pregnancy or

returning to high-performance sport post-pregnancy, which can contribute to development of sport policies, structures, and processes to support the health and well-being of female athletes.

- The Mum-Alete survey was co-created with the active involvement of athletes as 'knowledge experts' and other key stakeholder groups to promote relevance, holistic coverage and ecological validity.

- The online mixed-methods survey is cost-effective, time-efficient, and easily distributed and accessed.

- The test-retest reliability of the Mum-Alete survey was high with an excellent consistency of measures between the two time points.

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