Profiling hormonal contraceptive use and perceived impact on training and performance in a global sample of women rugby players

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Abstract

Purpose The potential impact of hormonal contraceptives on player health and performance in women's rugby union (rugby) is not well understood, despite rugby growing in popularity worldwide. This study investigated the prevalence of hormonal contraceptive (HC) use and reported associations with training and performance in a global sample of women rugby players.

Method A globally distributed online survey, seeking to explore experiences in women's rugby, was completed by 1,596 current or former adult women Seven's or 15's rugby players (mean age 27 ± 6 years; 7 ± 5 year's playing experience) from 62 countries. The survey included a section of questions about reported HC use, including the type, reason for use, symptoms and experiences relating to rugby training and performance.

Results A total of 606 (38%) participants from 33 of the 62 (53%) countries reported using HCs, with the combined oral contraceptive pill reported as the most frequently used (44%). Almost half of participants using HCs (43%) tracked HC-related symptoms. Over 10% reported altered rugby performance due to HC-related symptoms, 22% requiring medication to manage symptoms, and 11% using HCs to control or stop their menstrual periods for rugby training and performance.

Conclusion The current study highlights the prevalence of HC use in women's rugby, identifying practices that may negatively affect performance, health, and wellbeing. Thus, there is an urgent need to better understand the motivations for such practices, and knowledge of potential side effects amongst women rugby players across all levels and countries.

Key words

Synthetic hormones, athlete, performance, health, symptoms

Introduction

Optimal bodily function is reliant upon the communication between numerous organs and systems to ensure homeostasis[1]. Multiple hormones are involved in regulating bodily functions, such as growth and development, metabolism, electrolyte balance and reproduction[1]. In females, sex hormones fluctuate in a regular cycle which can cause a range of physiological and psychological symptoms, including abdominal cramps, fatigue, bloating and changes in mood[2,3]. In addition to reducing the chances of conceiving by affecting hormonal processes governing ovulation[4], synthetic hormonal contraceptives (HCs) are frequently used to reduce or alleviate symptoms. This may be beneficial for female athletes where menstrual-related symptoms have been shown to negatively affect training and sport performance[2,3]. Furthermore, the use of HCs provides an option to control or stop bleeding (e.g., manipulating the timing of a bleed for competition performance) with a means of offsetting any negative impact on female athlete performance[5]. The greater reported prevalence of HC use in athletic populations compared to the general population may be related to their potentially beneficial effects. Indeed, 47% to 63% of, British[6], Australian[7], Danish[8], Swedish[9], and Norwegian[9] athletes reported using HCs compared with 30% of the general population[10].

In the broader community, the use of HCs has been associated with unintended consequences for some individuals. Such symptoms include an increased risk of depression[10], negative mood changes, significantly reduced general wellbeing[11], and lower bone mineral density[12]. From a physiological perspective, emerging research has also demonstrated a greater oxidative stress and low-grade chronic inflammation associated with combined oral contraceptive use[13,14]. Specifically, in athletes, similar symptoms attributed to HC use have been reported by 40% of

participants across 57 different sports[9]. A recent review further highlighted that HC use may impair performance in some sportswomen[15]. Within athletes, HC use may delay recovery and/or cause muscle damage[16]. The impairment of physiological processes such as thermoregulation[17] and inflammation[13,18] have also been associated with HC use, with deleterious effects on training and performance.

Women's rugby is a fast-growing sport worldwide. There is increasing evidence, however, that many female players use HCs despite the reported side effects. In rugby and powerlifting athletes, Nolan et al.[19] found that of those using HCs, 40% reported negative side effects such as mood changes and headaches/migraines. Mood changes, along with weight gain and depression/anxiety, have also been reported in female Australian Rules football players using HCs[20]. The most reported HC-related symptoms in domestic level UK rugby players were bloating (79%), negative mood state (79%) and decreased energy levels (74%)[21]. Despite these findings, knowledge and awareness of the potential implications of HC use on rugby training and performance are lacking.

Most sport-related studies in this domain focus on naturally menstruating individuals and perceived effects on training. Despite the high prevalence of HC use among athletes, and reported negative side effects, existing research about their impact on athletic performance is limited or based on small sample sizes. These studies are also specific to Western countries, do not specifically relate to sports performance[6-9] and have not considered cultural nuances which may influence the use and perceptions of HCs. Therefore, the aim of this study was to determine the prevalence of HC use in a global sample of women rugby players, whilst investigating perceived associations with rugby training and performance.

Methods

Full methods have been reported in Brown et al.[22] but, briefly, a women's rugby survey was developed for players using an open, voluntary, cross-sectional design. This was distributed globally through rugby governing bodies and women's rugby social media platforms. Survey responses were recorded anonymously via a General Data Protection Regulation (GDPR)-compliant online survey platform JISC (jisc.ac.uk, Bristol, England). To enhance the number and accuracy of responses, the survey was professionally translated from English into eight additional languages: French, Spanish, German, Italian, Japanese, Welsh, Cantonese and Russian. The survey was launched in August 2020 and remained open for 12 weeks, until November 2020. A total of 1,596 participants from 62 countries (mean age 27 ± 6 years; 7 ± 5 year's playing experience) completed the survey. As reported in Brown et al.[22], specific response rates are unknown. For our analyses, countries were divided into the geographical regions stated in Table 1.

Insert Table 1 around here

Institutional ethics approval was obtained from the Swansea University College of Engineering Research Ethics Committee (reference number 2020-035). A participant information sheet was presented on the first page of the survey, followed by a consent form which participants were required to accept to open the survey. As all data were confidential, participants were informed that they would not be able to withdraw their responses once submitted. Participant eligibility included being ≥18 years and actively playing women's rugby 15s and/or sevens, or having done so in the past decade, at any level, in any country.

The data used in this study were a subset from a larger questionnaire investigating women's rugby, concussion and the menstrual cycle, which included a maximum of 149 multiple-choice and short-answer questions, presented in three sections. This study focused on data from questions specifically focused on the menstrual cycle and HC use. Questions included the type of HC used, reason for use, experiences of withdraw bleeds in relation to rugby, symptoms experienced because of HC use and in relation to rugby training and performance. At the start of the relevant section, participants were asked what sex they were assigned at birth, with subsequent questions tailored appropriately. Participants were asked if they were using HCs at the time of survey completion. Logic was applied to the survey to ensure only relevant questions were completed. This survey section was estimated to take no longer than 15 minutes and consisted of a maximum of 34 questions.

Aligned with the Checklist for Reporting Results of Internet E-Surveys (CHERRIES)[23], to prevent multiple questionnaire responses from the same individual, the data were screened to check for duplicate entries from the same user based on country, age, height, body mass, age started playing and years playing rugby (refer to Brown et al.[22] for full details). No duplicate responses were identified.

All questionnaire responses not completed in English, were translated into English (see Brown et al.[22] for full details). The raw data from the survey were exported from JISC directly to Microsoft Excel software to analyse descriptive data, displayed as frequencies and prevalence. Associations between countries, experiences and tracking were determined using chi-squared analyses with statistical significance set at $p<0.05$. Free-text responses were analysed using qualitative description (content analyses) by the first author. Counting frequency of words in text was completed for free-text responses reporting symptoms/side effects of HC use. Data reduction was completed using three stages of coding for data relating to perceived impact on training/performance. Firstly, descriptive codes were assigned to the data to identify raw data themes, this allowed for interpretive codes to be generated. These codes grouped descriptive codes into more abstract concepts. Lastly, pattern codes were identified which recognized relationships between interpretative codes[24].

Results

The use of HCs was reported by 606 participants (38%; Table 2), from 33 countries (53% of the 62 countries represented in the overall survey; Figure 1). Across all geographic regions, the highest reported use of HCs was among participants from South America (49%), and the lowest among those in The Middle East (0%; Table 3).

Insert Table 2 around here

Insert Figure 1 around here

The combined oral contraceptive was the most reported type of HC used (44%; Table 4). Over half (64%) of participants using HCs had done so for over three years, with 43% reporting use for at least five years. Less than half (43%) of participants tracked symptoms related to HC use but did not relate the symptoms to training. There was no association between country and participants that tracked their HC symptoms (χ^2 (597, 33) = 32.6, p = 0.488).

Insert Table 3 around here

Human Kinetics, 1607 N Market St, Champaign, IL 61825

Insert Table 4 around here

A total of 350 participants (58%) reported experiencing withdraw bleeds, 30% of which were related to use of the combined oral contraceptive. The experience of withdraw bleeds based on HC use did vary across geographic region (χ^2 (604, 14) = 28.7, $p < 0.011$; Table 3). Of those experiencing withdraw bleeds, only three participants (varying in player level; Premier, Club first division, recreational) did not take part in rugby whilst bleeding. Eleven percent of participants reported using HCs for the primary purpose of controlling or stopping menstrual periods/bleeding. This did not vary across countries (χ^2 (592, 33) = 46.5, p = 0.060) or geographic region (χ^2 (598, 7) = 10.5, p = 0.163; Table 3). One fifth (22%) of participants required the use of medication to manage HC-related symptoms, with no differences between geographic regions (χ^2 (362, 7) = 8.25, p = 0.311).

Among these 606 participants, 11% (n=67) reported that rugby performance was altered relating to HC use. There was no difference by country (χ**2** (584, 33) = 27.8, p = 0.725) or geographic region (χ**2** (582, 7) = 8.44, p = 296; Table 3). All 67 participants reported three or more HC-related symptoms that were perceived to negatively affect rugby performance. Stomach cramps were the most common (n=99, 25%), followed by fatigue/tiredness (n=185, 23%; Table 5).

Two categories were identified from interpretative codes in relation to perceived effect of HC use and related symptoms on rugby training/performance; 1) *Training/performance negatively affected due to HCs*, reporting feelings of being weak and tired or having reduced focus and motivation. Feelings of being slower, weaker, and heavier impacting running speed and distance were common, intensified by decreased energy levels; 2) *Missed rugby training* related to bleeding or experiencing stomach cramps (Table 6).

Insert Table 5 around here

Insert Table 6 around here

Discussion

The aim of this study was to determine the prevalence of HC use in a global sample of women rugby players, and to investigate perceived associations with training and performance. Out of 1,596 overall survey participants, 606 (38%) used HCs, with 11% of these 606 reporting a perceived negative impact on rugby performance. A range of HC-related symptoms were reported by participants, and two categories from qualitative analysis were identified regarding the perceived effect that HCs had on performance: i) *Training/performance negatively affected due to HCs*; and ii) *Missed rugby training.*

Out of all the participants surveyed in the present study, 38% reported using HCs. This is consistent with the prevalence reported in a UK premier domestic rugby population (36%)[21], and lower than that reported in athletes from 24 sports in a UK-based study (approximately 50%)[6] and Norwegian cross-country skiers and biathletes (68%)[25]. There were notable differences in the prevalence of HC use across geographic regions, and only 33 of the 62 countries included in the survey had participants who reported using HCs. Almost half of participants from South America (n=33) reported using HCs, compared with 9% from Asia (n=8) and none from the Middle East. This underscores the significance of cultural nuances

and their impact on player health, wellbeing, and performance. Nonetheless, it is also crucial to recognise that each athlete is unique and has multifaceted values[26], so individual player conversations and culturally sensitive considerations are paramount. It should be noted that while the number of countries sampled in the current study is high, comparison with existing studies is limited by the relatively low numbers of responses per country overall.

Previous work on athletes from rugby-related codes[20] and from 57 different sports[9] have reported the primary motivation for athletes choosing to use of HCs is to avoid pregnancy (82%[20] and 71%[9] of participants respectively). These studies additionally reported that reducing menstrual pain (41%[20] and 36%[9] of participants) and the control of menstrual periods (38%[20] and 31%[9], respectively) were of secondary importance. In the current study, non-contraceptive reasons for using HCs, primarily to control or stop menstrual periods, were reported by 11% of participants, and this did not vary across geographic region. This is considerably lower than the numbers previously reported[9,20]. Further investigation is needed to establish the non-contraceptive motivations for using HCs in the context of rugby performance, while considering the availability and acceptability of HCs in different regions. It is also crucial to examine the role of coaches, parents, and support staff in the player's decision to use HCs, and their potential effects on the player's wellbeing.

The ability to control menstrual timing through HC use offers some advantages for athletic training and performance, but it is important to consider the potential disadvantages. In the current study, 25% of HC-using participants reported experiencing stomach cramps, with 22% requiring medication to manage symptoms. Previous studies have also documented negative effects of HCs reported by athletes[19,20], leading some to discontinue use due to additional symptoms, including mood swings, weight gain and depression/anxiety[20]. This may be related to changes in neurobiology as a result of oral HC use, related to emotion and cognitive processing, however, there has been inconsistency in findings[4]. Athletes continuing HC use despite reporting adverse effects may do so for contraceptive reasons, but questions relating to sexual activity were not included in the survey. Previous research has, however, indicated that athletes may still prefer using combined oral contraceptives to manage menstrual-related complications despite this affecting performance[2].

Specific symptoms experienced may also differ with HC type, depending on the synthetic hormone formulation of progestin only or combined oral contraceptives. For example, the type of progestin used in some formulas is anti-androgenic in that it can effectively reduce androgen signaling at the androgen receptor[27]. Other types of progestin can be androgenic, up-regulating androgen efficacy in binding and action[4]. Depending on the formula, hypo-hyper-estrogenic and progesterogenic effects could be conflated with their indirect effects on androgen action in the brain. Despite androgens potentially playing a less pronounced role in females compared to males, this may still have consequences from a sport performance perspective[4].

Previous research has reported no difference in perceived side effects[25], whereas others demonstrated that perceived negative side effects were more common with progestin only than combined oral contraceptives[6]. Further consideration is required for differences in the systemic (pill or implant) versus localized (intrauterine device) release of hormones[28]. Martin et al.[6] reported implant-users had higher perceived prevalence of side effects compared to pill-users, but research has not explored the differences between systemic and localized within an athlete population and subsequent impact on athlete health and performance. Further research is needed to determine which specific types of HCs may be beneficial for athletes and in what circumstances they should be used.

When considering the impact on rugby performance, non-oral HC users have been shown to have up to 52% higher levels of salivary testosterone compared to oral contraceptive users both pre- and post-training[29] and competition[30,31]. This is particularly noteworthy given that Oliveira et al.[32] reported that winning in sport is associated with an elevated testosterone response. The disparity in testosterone levels between oral HC users and non-users has not been related to performance statistics or match performance at a group level. However, research has reported that individual salivary testosterone levels were related to the number of positive actions during a match and may be associated with improved competition performance[31]. Within the performance measures reported by Crewther et al[31], there was a focus on physiological match performance statistics, whereas group level differences between general populations of oral HC users and non-users have previously been related to psychological components such as neural, cognitive, emotional and behavioural effects[4]. Future research should bridge the gap between understanding the neurological, psychological and behavioural effects of HCs and sports performance measures. This would be a powerful avenue of future work and help to explain the link between HCs and performance.

Study Limitations

Whilst the global nature of the present study represents a significant strength, there are limitations that should be acknowledged. Despite good global coverage, there are low responses within some geographical regions (e.g. The Middle East and Africa). Since this study aimed to determine prevalence of HC use amongst women rugby players, the low response rates from some regions is not necessarily a limitation, however, this did limit the data analyses we were able to complete with regards to comparisons between countries. Recall bias amongst retired rugby players is another issue, where they are unable to accurately recount their experiences with HC use during their career when completing the survey. There is a lack of detail in the current study regarding the reasons for use of HCs, including sexual activity; additional survey items in this area would have allowed further comparisons to previous research and increased understanding of HC use despite prevalent negative symptoms and associated impact on training and rugby performance. Furthermore, the survey did not ask if symptoms were discussed with coaches or medical professionals, which would have assisted with the development of recommendations provided for supporting women in rugby. In addition, duration of HC usage was not determined from our survey, which might affect symptoms and their severity.

Practical Applications

In line with previous research, differing symptomology relating to HC use were reported; 13% of individuals in the present study reported no symptoms or negative effect on training and performance. However, individuals using HCs in the current study also reported negative side effects and associations with rugby training and performance. Therefore, women rugby players may benefit from annual menstrual cycle profiling to include HC use, type and symptoms perceived to impact training/performance and supported by regular monitoring of symptomology to help optimize health and performance. Training and education programs prior to these practical recommendations may assist the implementation of this into practice, whilst also helping individual players to make informed decisions on types of contraceptives available, management of related symptoms, and subsequently improved understanding to support the importance of communication with coaches and support staff.

This aligns to practical recommendations in rugby which have been provided by Findlay et al.[2], including educating athletes, coaches and support staff. This aimed to develop awareness, openness, knowledge and understanding of the menstrual cycle within a sporting environment. However, following the results of the current study, we suggest the recommendations by Findlay et al.[2] could be extended to include educational programs on HC use. This amendment should also be reflected across the recommendation to provide a 'point of contact' for players to approach with menstrual related concerns[2], this should not be limited to players naturally menstruating, but also for those using HCs.

Conversations between coaches, players and support staff are recommended to determine the reason for use of HCs, any associated negative symptoms experienced and their effect(s) on training and match performance. However, this must be balanced with an appreciation of the sensitivities of this information, which may vary between and within different cultures. If players feel comfortable having these discussions, they could enable the identification of positive management strategies for negatively affected individuals that can be implemented within a team environment. Relatively small, but worldwide improvements in this area could potentially make significant changes in performance and welfare in women's rugby.

Conclusions

This study is the first to explore HC use in a global sample of women rugby players. The results highlight a difference in HC use worldwide, and associated experiences and symptoms varied in severity. Some participants reported altered performance, use of medication for management or even withdrawal from rugby training/performance in relation to HC use. These outcomes varied in severity and across geographic regions. It is important to understand the self-reported experiences and perceptions, in terms of the bio-psycho-social effects of using HCs on sportswomen, in addition to that of those with natural menstrual cycles.

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Conflict of Interest – The authors declare no conflicts of interest.

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Ethics Statement - The studies involving human participants were reviewed and approved by Swansea University College of Engineering Research Ethics Committee (reference number 2020-035).

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Figure Captions

Figure 1: A) Number of participants reporting use of hormonal contraceptives, B) Percentage of hormonal contraceptive users from total responses, displayed by Country

Tables

Table 1: The total number of survey responses from each geographical region, and the countries comprising each geographical region.

Region (N)	***Countries***
Africa (30)	Egypt (4), Ivory Coast (2), Kenya (2), Mauritius (1), South Africa (17), Swaziland (1), Zimbabwe (3)

Asia (98)	Brunei (1), Hong Kong (41), Indonesia (1), Japan (20), Laos (2), Malaysia (13), Philippines (10), Singapore (5), Taiwan (2), Thailand (3)
Europe (397)	Austria (9), Belgium (2), Croatia (2), Curaçao (1), Czech Republic (6), Denmark (2), France (54), Georgia (5), Germany (36), Italy (66), Latvia (1), Netherlands (59), Norway (2), Russia (1), Spain (138), Sweden (6), Switzerland (7)
North America (249)	Canada (127), USA (122)
Oceania (165)	Australia (38), Fiji (3), New Zealand (120), Papua New Guinea (1), Samoa (3)
South & Central America (67)	Argentina (15), Barbados (1), Bolivia (1), Brazil (2), Chile (7), Colombia (32), Jamaica (1), Mexico (1), Panama (5), Paraguay (1), Trinidad and Tobago (1)
UK & Ireland (563)	Ireland (138), Bermuda (1), England (278), Northern Ireland (38), Scotland (46), Wales (62)
Middle East (9)	Israel (3), Jordan (4), Lebanon (1), UAE (1)
Not Stated (18)	
Total (1596)	

Table 2: Participant characteristics reporting use of hormonal contraceptives

	Total (n = 603)
Age (yrs)	24.5 ± 4.4
Height (cm)	167.3 ± 7.0
Body mass (kg)	74.3 ± 14.4
Age started playing rugby (yrs)	16.2 ± 5.1
Rugby experience (yrs)	8.0 ± 3.9

Data reported as mean ± SD

Table 3: The number of participants using hormonal contraceptives and associated experiences based on geographic region (n = 606). The percentage of participants is captured by row

	HC use	**Experience a withdraw bleed**	**Use HCs to stop/control timing of bleed**	**Perceived performance affected**
Africa	8 (27%)	3 (38%)	2 (25%)	0 (0%)
Asia	9 (9%)	3 (33%)	2 (22%)	1 (11%)
Europe	148 (37%)	94 (64%)	9 (6%)	11 (7%)
Middle East	0 (0%)	0 (0%)	0 (0%)	0 (0%)
North America	114 (46%)	55 (48%)	13 (11%)	12 (11%)
Oceania	62 (38%)	28 (45%)	10 (16%)	4 (6%)
South America	33 (49%)	27 (82%)	4 (12%)	5 (15%)
UK & Ireland	226 (40%)	137 (61%)	26 (12%)	32 (14%)
Other	33 (33%)	4 (67%)	0 (0%)	0 (0%)

Table 4: Reported type of hormonal contraceptive used (n = 606)

Type of Contraception Used	Number of Responses	Percentage
Combined Oral	267	44
Contraceptive Implant	82	14
Contraceptive Injection	24	4
Contraceptive Patch	1	0
Intrauterine Device	114	19
Progesterone Only (Mini Pill)	101	17
Other	14	3

Table 5: Symptoms reported to affect rugby training/performance (n = 513)

Symptoms	Number reported	Percentage
None	100	12.5
Cramps	199	24.8
Fatigue/tiredness/low energy	185	23.1
Mood/emotions	36	4.5
Bloating	30	3.7
Headaches	30	3.7
Back ache/pain	21	2.6
Irritable	15	1.9
Body ache/pain	13	1.6
Nausea	13	1.6
Low motivation	12	1.5
Heavy bleeding/flooding	11	1.4
Lightheaded	10	1.2
Weak	9	1.1
Slow	5	0.6
Breast pain	4	0.5
Diarrhea/constipation	3	0.4
Clumsy/coordination	2	0.2
Longer recovery	2	0.2
Concentration/focus	9	0.1
Leg cramp	1	0.1
Increased temperature/effort	1	0.1

Table 6: Participants' perception of hormonal contraceptive-related symptoms/side effects on training and rugby performance

Category	Codes	Example Quotes
Training/performance negatively affected by symptoms/side effects of hormonal contraceptives	Tired Decreased energy levels Focus and motivation reduced Feelings of being slower, weaker and heavier	"During my week off of birth control I feel bloated, slow and cramps. All of these affect my physical performance." "I feel weaker around the time of my withdrawal bleeding as it makes me feel nauseous" "Feeling tired and bloated affect my training" "I hate being on my period while playing because I feel more drained"
Missed rugby training	Bleeding Stomach cramps	"It's very heavy so I generally just avoid training in general. When it's not heavy I don't train because of the pain and general discomfort if we were doing tackling" "75% of the time I will power through and train anyway but 25% of the time I will miss training as a result"

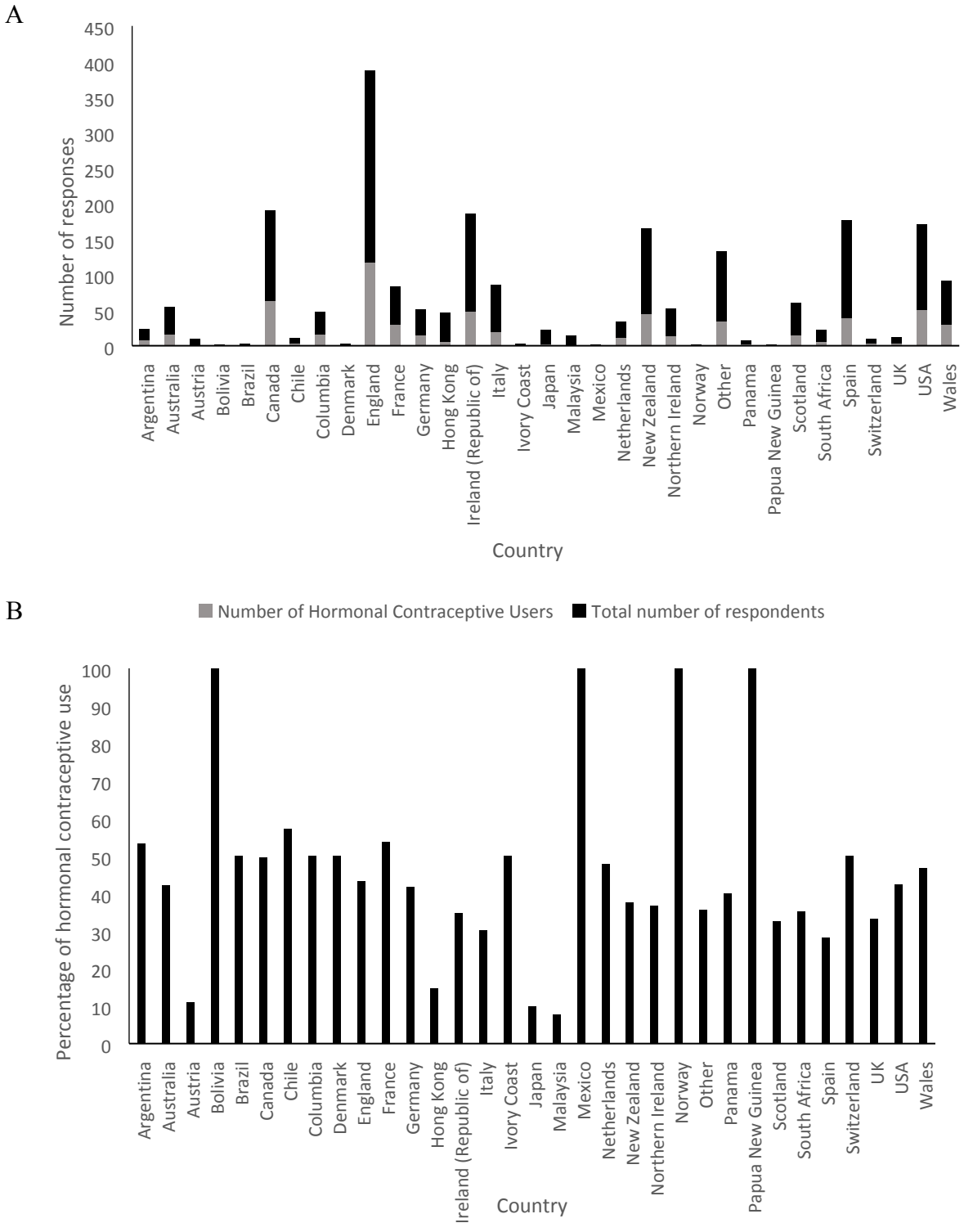

Figure 1: A) Number of participants reporting use of hormonal contraceptives, B) Percentage of hormonal contraceptive users from total responses, displayed by Country