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Original research

Probiotic supplementation reduces the duration and incidence of infections but not severity in elite rugby union players

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ABSTRACT

Objectives: The attenuation of the number and severity of infections is of importance to athletes. Probiotics use has increased over recent years with beneficial effects believed to include improvements in immune function. Research has focused on their effectiveness for reducing the number, duration and severity of infections amongst endurance athletes. At present no research has been undertaken with team sport athletes. This randomised controlled trial aimed to determine the effectiveness of probiotics on the number, duration and severity of infections amongst elite union rugby players.
Design: Randomised control trial with two arms; placebo and probiotic.
Methods: Thirty elite rugby union players were allocated in random order to receive a probiotics supplement or a placebo for four weeks each. Supplements were consumed on a daily basis. There was a four week washout period between treatments. Participants completed a daily diary to identify and rate the severity of any infectious symptoms.
Results: During the probiotic treatment 14/30 participants never experienced a single upper respiratory tract illness (URTI) or gastrointestinal (GI) episode, compared to 6/30 on the placebo supplementation ($p = 0.033$). The mean ± standard deviation for the number of days of illness tended to be higher for the placebo, (5.8 ± 6.6 days) than probiotic (3.4 ± 4.6 days), ($p = 0.054$). There was no significant difference in the severity of the symptoms between the two treatment groups ($p = 0.110$).
Conclusions: These positive effects of probiotic supplements provide evidence for the beneficial effects of daily supplementation with these probiotic strains in highly trained rugby union players.

1. Introduction

Athletes engaging in prolonged intense exercise may be more susceptible to upper respiratory tract illness (URTI), than individuals participating in moderate or no exercise.[1,2] Attenuating the risk of infection is of interest to coaches and sports physicians, as illness can result in impaired performance or missed training days. Elite rugby union players can train for approximately four to five hours a day 5–6 days a week with competitive matches once a week. This intensive training schedule may put these players at increased risk of URTI and suppressed immune function whilst at the same time increasing exposure to pathogens.[3–5] In team sports settings, where athletes are competing on a regular basis in such close proximity, sharing bottles and shaking hands, the risk viruses will be passed on to other members of the squad is increased.[6] This is especially true in contact sports.

One emerging supplement that may attenuate the risk of some infections are probiotics. These supplements alter gut microflora, which may stimulate immune function and have been associated with numerous health claims; the majority of which have focused on their beneficial effects on the immune system and/or the gastrointestinal tract. The benefits from probiotic supplementation is believed to be strain specific, as only a few strains have been found to survive gastric transit and can persist in the intestinal lumen.[7,8] Therefore, the most common strains used to promote immune function are lactic acid bacteria (LAB); Lactobacillus and Bifidobacterium species.

A handful of studies have been published which investigate the effects of probiotic supplementation and immune function amongst athletes.[9,11,15] The predominant population of focus in these studies has been endurance athletes. The duration of the interventions have ranged from three weeks to four months.[9,10] Although the probiotic strains, concentrations and administration methods have varied, they have generally shown beneficial effects.

Therefore it appears that probiotic supplementation may be beneficial by attenuating illness in endurance athletes. However,

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to date there is limited evidence to suggest rugby union players will also benefit from probiotic supplementation. Therefore this intervention study aimed to investigate the effect of four weeks probiotic supplementation on the incidence, duration and severity of infections during a month of competitive rugby union. Thus, testing the hypothesis that probiotic supplementation would reduce the number, duration and severity of infection symptoms amongst elite rugby union players.

2. Methods

The study was a randomised, single-blind, placebo-controlled, crossover trial with two arms: probiotics and placebo. Each treatment arm lasted four weeks, separated by a 4 week washout period, between the winter months of May to July (temperature range −4 to +18 °C). Probiotics or placebo supplements (independent variables) were consumed on a daily basis and a symptoms diary[8–10] was completed every day to identify the dependant variables; symptoms of upper respiratory tract, gastrointestinal and other infections. The use of self-reported infections allow for a better understanding of how a player feels and minimises the burden on participants compared to blood samples, which is important in an elite sports setting.

The University of Otago Human Ethics Committee approved this study, and the measurements were described to all players before they gave their written consent to participate and the study complied with the declaration of Helsinki at all times.

All participants were elite rugby union players competing in the southern hemisphere's premier rugby union competition. Thirty healthy young (mean ± standard deviation) 24.7 ± 3.6 years old, male rugby union players participated in the study. Mean body mass was 104 ± 12.8 kg (Tanita Personal scale UM-071) on the morning of the first day of the trial before training commenced.

Throughout the study participants continued with their normal training and competition programme. They were asked to maintain a normal diet, yet were given instruction to refrain from eating probiotic-enriched yoghurt and probiotic and prebiotic enriched foods or supplements (probiotic, vitamins and minerals) during this period.

During the study participants trained 4 days a week at the training centre (typically around 4 h per day), and participated in 1 day of competition and 2 days of self-regeneration and light training. Training included gym work, weights, skills, and fitness tests. Each week, a team was named for competition. Those not named in the competition team trained at the training centre 5 days a week.

Participants were provided in random order with either a commercially availiable probiotic gelatine capsule or a placebo capsule containing cornflour. The probiotic capsules containing three acid-resistant strains of bacteria (*Lactobacillus gasseri*: 2.6 billion colony-forming units (CFUs), *Bifidobacterium bifidum*: 0.2 billion organisms, *Bifidobacterium longum*: 0.2 billion organisms) (Probiotica P3, Nutra-life, Auckland, New Zealand). This product was chosen as it contains the lactobacillus strain of probiotics which have previously been shown to be beneficial for athletes[10] and does not need to be refridgerated making it more convenient for use in a team sport setting.

Participants were required to consume one pill per day throughout the two arms of the trial and at the same time to complete a symptoms diary on infection and severity. To enhance compliance, a researcher attended training sessions each day and provided the participants with their allocated capsule in a named container. At this time the participants also completed a daily symptoms questionnaire.[9–11] On the days that participants were not training, participants were given a pack of capsules to take away with them and were sent a reminder via SMS to take their capsule each morning. For the non-training days, a compliance log of supplement use was recorded and participants were asked to report if they had missed any days of supplementation. Participants were also required to continue to complete daily symptoms questionnaires and bring them to the next session. If symptoms forms were not returned the participants were asked to report any symptoms of illness and fill in another form. Participants were required to report any medications they were taking during the intervention period (e.g. pain killers) however; they were not required to abstain from any medications if they were suffering from illness symptoms. At the end of each intervention period the participants were asked to identify which treatment they thought they had just completed.

The symptoms questionnaire has previously been described[9,10,12] and covered the following types of infection: upper respiratory tract and chest infections, influenza, gastrointestinal distress, headache, eye irritation, rashes, skin abscesses and other. The severity of the symptoms were self-rated as mild, moderate and severe based on the impact of the illness symptoms on the subject's training volume and intensity for the day. Mild, resume normal training; moderate, normal/altered training; severe, altered/no training. Injuries were considered when symptoms were recorded, for example, with headaches it was questioned whether it was due to training/competition injury (concussion) or illness related. The incidence score relates to the number of participants who reported that symptom during each arm of the study. One or more symptoms on at least two consecutive days were defined as an episode of illness. Symptoms only separated by one day were counted as the same episode.

In order to detect a 30% reduction in the number of infected days with 80% power and type 1 error of 5% a total of 25 participants were required. Accounting for dropouts, 34 participants were recruited at baseline.[8]

All analyses were conducted using STATA version 12 (STATA Corporation, College Station, TX, USA) with statistical significance set at $P \leq 0.05$. The incidence of symptoms were compared between the two treatments using McNemar's test for presence/absence of symptoms. The Wilcoxon's matched-pairs signed ranks test was used to compare the severity of symptoms, the number of episodes of illness, and the length of episodes of illness between treatments. Compliance to the two treatments was compared using a paired *t*-test.

A total severity score was calculated by summing all of the severity scores for all symptoms over the 28 day intervention. A total illness score was calculated by multiplying the total severity score by the number of days of illness. The Wilcoxon's matched-pairs signed ranks test was used to compare the total severity score and the total illness score between treatments. Data are presented as mean ± standard deviation unless otherwise stated.

3. Results

Adherence to the study was good, the mean number of days missed per participant during the probiotic trial was 3.7 days (range 1–9 days) and during the placebo trial was 4.4 days (range 1–14 days) which was not significantly different between the trials, $p = 0.233$.

Upon completion of the study, participants were asked to identify which treatment they thought they had just completed. Seventy percent reported they did not know, 13% thought they were on the probiotic, and 17% thought they were on the placebo. Of the participants who answered they thought they were on either the probiotic or placebo, 44% were correct and 56% were incorrect. Thus blinding appeared to be effective.

There were no substantial differences between the treatments in terms of the mean amount of competitive matches played