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ARTICLE

Making the best food choices before competing: Developing and evaluating a nutritional intervention with the intervention-mapping framework
Morin Pascale, Frechette Martin, Grand’Maison Sara, Lavoie Jose and Jean-Francois Belanger
Making the best food choices before competing: Developing and evaluating a nutritional intervention with the intervention-mapping framework

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This article describes the development, implementation, and evaluation of a nutritional intervention held during the Canada Summer Games – Sherbrooke, 2013. This multicomponent intervention combined environmental and educational strategies, focusing on helping athletes in making adequate food choices before their competition. Intervention mapping was used to guide the intervention process focused on food offerings, coaches, and athletes. A committee was formed, a food policy was adopted, information was sent to the coaches prior to their arrival on site, and the cafeteria was plastered with posters indicating to athletes the best food choices before competing. A convenience sample of 48 athletes and 77 coaches answered questions pertaining to how they perceived the intervention. According to the results, many of the athletes stated that the information on the posters was useful in choosing their foods. Eight of them indicated that they used the poster information to achieve better performance. Thirty-six athletes expressed an interest in seeing the intervention components displayed at future competitions and stated that they would use the poster content at other sports events. Twenty-eight athletes suggested that plans should be made to better promote the nutritional intervention before the games. Although 51 coaches stated that they paid particular attention to the nutrition of their athletes, the median outcome on knowledge questions was 63.6%. Ninety percent of the coaches indicated that they deemed the information as being relevant. Overall, this novel intervention revealed a high satisfaction level among athletes and coaches in spite of the few gaps in promotion.

Key words: Diet, athlete, physical activity, food habits, food services, health promotion.

INTRODUCTION

According to the American College of Sports Medicine, Dieticians of Canada, and the American Dietetic Association's joint position paper, adequate dietary intake improves physical capacity, athletic performance, and recovery (Rodriguez et al., 2009). The nutrient type and intake timing stand out as factors influencing the physiological adaptations required for maintaining optimal body composition and athletic performance (Rodriguez,
2009; IOC, 2011). For example, a full meal eaten three to four hours before exercise, with significant carbohydrate, adequate protein, and low fat content, promotes optimal energy levels and satiety, while avoiding discomfort such as fatigue and gastrointestinal distress (Bagchi et al., 2013; Rodriguez et al., 2009; Australian Institute of Sports, 2009). If eating a full meal is not possible, a light snack comprised mainly carbohydrate is generally necessary an hour or two before exercising or competing (Bagchi et al., 2013; Rodriguez et al., 2009; Australian Institute of Sports, 2009).

However, everyday athletes’ eating habits do not always meet their nutritional needs. Some may have suboptimal intakes pertaining to the carbohydrate (Shriver et al., 2013), protein (Martinez et al., 2011), lipid (Arenhouts, 2011), vitamin, mineral (Gibson et al., 2011; Martinez et al., 2011), and water content of their usual diet (Arenhouts, 2011). Moreover, during high-level sports events, as food is usually presented in a buffet-style in the village cafeteria, athletes are faced with the challenge of choosing the right food before performing in a context of variety, abundance, and sometimes lack of supervision (Australian Institute of Sport, 2009). Studies show that athletes rely upon their coaches as sources of information regarding their nutrition (Cotugna, 2005; Douglas, 1984; Jacobson, 2001; Parr, Porter, 1984). Nevertheless, athletes, as much as their coaches, lack the necessary knowledge required in order to make sound nutritional choices and, consequently, to perform under optimal conditions such as high energy level, high mental alertness and absence of gastrointestinal distress (Bedgood, 1983; Corley, 1990; Graves, 1991; Juzwiak and Ancona-Lopez, 2004; Smith-Rockwell et al., 2001; Torres-McGehee et al., 2012; Zinn, 2006).

An improvement of the nutritional value of foods offered at sport events, without sacrificing their palatability would prove to be a judicious way to create an environment that will facilitate sound food choices. The Atlanta Games of 1996 were the first to improve the nutritional value of the meals served at the Athletes’ Village (ComitéAtlanta pour les Jeuxolympiques, 1997). For the 2000 Olympic Games, Pelly et al. (2009) developed and implemented a menu based on scientific literature, food-preference surveys and nutritionists’ expertise. Consequently, in the cafeteria, athletes could select foods according to point-of-choice nutrition labels of a standard serving. For the 2012 London Olympic Games, the US sports nutritionists developed posters guiding athletes towards the selection of food according to the intensity of their training (USOC, s.d.). The posters were placed at the entrance of the cafeteria and a promotion program was implemented. Thus, from one sports event to another, focus on the nutritive aspect of food services has been overlooked (Pelly et al., 2009). An official food policy governing the nutritional content of the food offerings during sports events would bring consistency.

Theoretically, a policy proposes a vision, establishes objectives, defines terms, and frames the action so the environment can achieve coherence with healthy behaviours. A food policy supports organizers in promoting healthy eating habits by guiding, for example, food purchases and preparation, by regulating the amount of each food group to provide in order to sustain adequately each athlete in whichever sport he competes. Since a recent systematic review concluded that more research is necessary to clearly demonstrate if athletes’ nutrition knowledge can be transferred into more appropriate food choices (Heaney et al., 2011), a systematic enhancement of the food environment during high level competitions could help athletes make better food choices by facilitating or guiding the latter.

The project described in this paper took place during the Canada Summer Games – Sherbrooke 2013 which hosted 3389 athletes and 504 coaches from 13 provinces and territories. It was an intervention project that promoted healthy eating with a food policy, which structured the purchasing processes and established the food preparation and distribution regulations so that the village athletes could eat nutritious foods at all times. As well, the project allowed to educate athletes and their coaches to choose their food wisely in relation to the timing of their event. This article therefore aims at describing the process for designing, implementing, and evaluating the project called 3-2-1-GO!

**METHODS**

The intervention-mapping (IM) framework was used to ensure that our multi-component intervention was developed scientifically and systematically (Bartholomew et al., 2011). The IM framework has already demonstrated its usefulness in guiding effective nutritional interventions (Taylor et al., 2013; De Decker et al., 2014; Brug et al., 2005). The use of IM makes it possible for interventions to consider altogether environmental and individual variables so we could elaborate a project that would encompass the food offerings in the Athletes’ Village cafeteria and target interventions to inform the athletes and the coaches on the best food choice they could make before competing. Theoretically, the IM framework comprises six steps, from identifying health issues to applying the proposed solutions. These steps are described in detail according to the actions implemented for the Canada Games:

1. **Conduct a needs assessment:** A steering committee consisting of athletes, registered dieticians, physical educators, public-health specialists, and the food-service manager was formed a year and a half before the Games. Two of the physical educators involved in the steering committee chose this project to fulfill their Master’s Degree requirements. Following the needs assessment, the theoretical determinants were determined: the availability of highly nutritional foods in the cafeteria and exposure to educational information from different sources were deemed facilitating factors; the coaches’ support was regarded as a reinforcing factor for the athlete’s eating behavior.

2. **Create matrices of change objectives:** The expected changes were that the Village cafeteria would offer healthy foods on a daily basis during the Games and act as the major knowledge diffusion center. The coaches would get a global knowledge of the educational material and encourage their athletes to eat accordingly. The athletes would take the advice shown in the cafeteria and on the website. They would use the portion they need
Figure 1. 3-2-1-GO! Project flowchart.

according to their appetite.

3. Select theory-based intervention methods and practical applications: We used a variety of theories, such as social-cognitive theory and the socio-ecological framework to transform the change objectives into practical applications (Cohen et al., 2000; Gibson, 2008). We targeted the food service and the Games’ website as the environmental components mostly associated with the athletes’ context (Story et al., 2002). As for the individual components, we focused on finding the best way to inform the coaches about the project and on producing easy to read and visually attractive educational material for the athletes (O’Donnell, 2005).

4. Produce an intervention program: As Figure 1 shows, the Games’ organization featured a food service and hired a registered dietitian, specialized in sports nutrition, to manage it. The manager drafted a food policy that was endorsed by the Games’ Board of Directors and the Canada Games Council. The steering committee conceptualized various strategies to promote the food policy, to inform the coaches about the intervention and stress their importance in supporting their athletes in eating optimally according to the event, to educate the athletes with the best food choices prior to their events, to raise the website users’ awareness about sports nutrition.

Prior to the games, the manager reviewed the cafeteria menu in order to follow the statements articulated in the food policy and tested the menu during a previous event for its palatability. The steering committee identified ways to intervene with athletes and coaches: the educational material would be presented during a press conference and a leaflet would be sent to the coaches via the heads of mission. The educational material consisted of a bilingual 3-2-1-GO!Poster available in three different formats (Appendix). Athletes could select the most appropriate meal or snack type depending on the timing before competition: 1- in over three hours; 2- in two to three hours; 3- in one to two hours; and 4- in less than an hour. The poster was validated for understanding with eight varsity athletes and minor adjustments were made. It was printed in various sizes: 1 measuring 8 feet by 4 feet was placed at the cafeteria entrance; 16 measuring 2 feet by 3 feet were positioned above food-service islands (e.g., over the islands for the daily special or for snacks and desserts); and more than 100 cards (4 inches x 6 inches) were distributed among the dining tables. The steering committee visited the food service area to seek for eye-catching places to pin up the posters. As educational material, the steering committee also produced an information leaflet intended for the coaches, and total of 11 nutrition tips, which were about 800 words each, pertaining to healthy eating at home, healthy eating when travelling, hydration, energy drinks, and so on. The nutrition
tips were placed on the Games’ website for the coaches, the athletes, and the public to read.

**Plan program implementation:** The food-service manager held a press conference six months prior to the Games to announce the food policy, informed the nutrition content of cafeteria meals, and the 3-2-1-G0/education material. The heads of mission had to relay the information to the coaches since direct contact with the athletes and the coaches was restricted. A few days prior to the Games, the 3-2-1-G0 posters were pinned up on the walls of the food service area and the 4 x 6 cards were placed on each table’s napkin dispensers. During the games, the steering committee members were on site to answer questions. A follow up was made with the people in charge of communications during the Games to ensure the website’s nutrition tips were available and promoted on Twitter and Facebook.

**Evaluate the program:** In order to evaluate if the 3-2-1-G0 intervention helped athletes in making better food choices according to their event time, we proposed an implementation and an impact evaluation protocol. The evaluation objectives were to: 1) check the availability of the food and the educational material in the food service and on the website (implementation). Thus, athletes could readily choose the appropriate food according to their event schedule; 2) verify if the coaches had received the leaflet from the heads of mission and if they had transmitted the information on the 3-2-1-G0 project to the athletes (implementation) so that they could support the athletes in making the best food choices; 3) verify if the athletes had heard of and used the information from the educational material to plan their pre-event meals impact.

To determine availability and posters visibility, committee members made daily rounds using an observation tool. In order to follow upon the website’s nutrition tips users, statistics were compiled daily by the Games’ communications staff (numbers of daily users and duration of each stay on the site).

In order to reach objectives 2 and 3, the two Master’s Degree students recruited coaches and athletes in the Village’s cafeteria once they had finished their meal. They had to interview at least 30 participants from each subsample, from a diversity of disciplines and provinces in order to produce the most comprehensive evaluation. Participants had to be 18 years or older, and speak either French or English. After having been informed of the research objectives, the athlete had to sign an informed-consent form. For the coaches, completing the questionnaire was deemed consent. The interviews and questionnaires were conducted anonymously.

With respect to the instruments: 1) the observational tool referred to a check list that systematically verified the presence of sufficient food in each food-service island, the presence of the posters; 2) A ten-minute, self-administered questionnaire was developed for the coaches. They explored their beliefs about the importance of nutrition for performance, their ability to share nutritional information with their athletes (e.g., "On a scale of 1 to 10, where 1 means "not at all confident" and 10 means "very confident", please indicate your level of confidence in sharing your knowledge about sports nutrition with your athletes"); their knowledge about sports nutrition based on four true or false and seven multiple choice questions inspired from Moussavou-Nzamba (2008), Cupisti et al. (2002), Dobbe (2005) and Meo (S.d), and their impressions of the intervention (e.g., "Have you informed your athletes about the best food choices to make before competition? Did you find the information leaflet relevant in the context of the Canada Summer Games - Sherbrooke 2013?"); 3) A ten-minute interview guide was developed to examine athlete exposure and use of the 3-2-1-G0/poster (e.g., "Are you aware of the project? How did you come across the posters? Did you read the information written on the poster to choose your food?").

The questionnaires filled by77 coaches representing 17 disciplines and 12 provinces and territories, were analyzed (objective #2) (Table 1). The large majority of the coaches believed that an optimal diet would improve athletic performance (n = 74; 96%), that an optimal diet was essential before competing or training (n = 73; 95%), and that they would pay extra attention to their athletes’ nutrition during competitions (n = 51; 62%). More than 75% of respondents had provided nutritional information to their athletes. The median result for the 11 questions about sports-nutrition knowledge was about 63.6%. There was a significant association (p < 0.05) between their self-estimation of knowledge and their test results (Spearman’s correlation = rs = 0.264; p = 0.021). There were significant associations between their self-estimation of sports-nutrition knowledge and their degree of comfort in sharing it with their athletes (rs = 0.642; p < 0.001) as well as with the extra attention paid to their athletes’ nutrition during competition (rs = 0.278; p = 0.014). Only 22 coaches indicated that they had received the information leaflet describing the 3-2-1-G0 project provided by a head of mission in the weeks leading up to the Games. Of these, 20 coaches (91%) stated that they read the leaflet and found it relevant. Lastly, 65 coaches (93%) stated that there were good reasons to have the 3-2-1-G0 project at the next Canada Games.

A total of 48 athletes between the ages of 18 and 24 years from eight provinces took part in the interviews (objective #3). Table 2 represents the sports included in the study.

 Forty-one of them (85%) deemed diet on the day of competition important or very important. Nine (19%)
Table 1. Coaches’ characteristics.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>(N = 77)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>51</td>
<td>66.2</td>
</tr>
<tr>
<td>Women</td>
<td>26</td>
<td>33.8</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 25</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td>26-35</td>
<td>26</td>
<td>33.8</td>
</tr>
<tr>
<td>36-45</td>
<td>22</td>
<td>28.6</td>
</tr>
<tr>
<td>46-55</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>&gt; 56</td>
<td>7</td>
<td>9.1</td>
</tr>
<tr>
<td>Coach status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head Coach</td>
<td>37</td>
<td>48.1</td>
</tr>
<tr>
<td>Assistant Coach</td>
<td>33</td>
<td>42.9</td>
</tr>
<tr>
<td>Manager with coaching experience</td>
<td>7</td>
<td>9.1</td>
</tr>
<tr>
<td>Experience as a certified coach (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 5</td>
<td>11</td>
<td>14.3</td>
</tr>
<tr>
<td>6-10</td>
<td>23</td>
<td>29.9</td>
</tr>
<tr>
<td>11-15</td>
<td>14</td>
<td>18.2</td>
</tr>
<tr>
<td>16-20</td>
<td>14</td>
<td>18.2</td>
</tr>
<tr>
<td>21-25</td>
<td>7</td>
<td>9.1</td>
</tr>
<tr>
<td>&gt; 25</td>
<td>8</td>
<td>10.4</td>
</tr>
<tr>
<td>National Coaching Certification Program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 2 NCCP or equivalent</td>
<td>9</td>
<td>11.7</td>
</tr>
<tr>
<td>Level 3 NCCP or equivalent</td>
<td>64</td>
<td>83.1</td>
</tr>
<tr>
<td>Level 4 NCCP or equivalent</td>
<td>4</td>
<td>5.2</td>
</tr>
<tr>
<td>Having access to a dietician</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>49</td>
<td>63.6</td>
</tr>
<tr>
<td>No</td>
<td>28</td>
<td>36.4</td>
</tr>
<tr>
<td>Training in sports nutrition (n)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>14</td>
<td>18.2</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>14.3</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>18.2</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>15.6</td>
</tr>
<tr>
<td>4</td>
<td>26</td>
<td>33.8</td>
</tr>
</tbody>
</table>

athletes stated that they were aware of the project before the Games started, whereas the others (n=38; 81%) indicated that they learned about it during the Games. Athletes were aware of the project primarily because of the 8 feet by 4 feet poster at the cafeteria’s entrance (n=33; 70%), while the stations’ posters and the cards on the dining tables got the attention of 2 and 15 athletes respectively. Generally, the athletes affirmed that they found the content of the educational material useful and very useful in making their food choices. Out of the 16 (33%) athletes who used the poster to choose one or more of their meals, eight indicated that they did so to achieve higher performance, five did so to conform, and three did so because their coaches expressly asked them to. Out of the 31 (65%) athletes who mentioned that they did not use the educational material 13 specified that they already had the knowledge, 12 relied solely on their own dietary routines, 2 lacked time, 2 were not interested, and another 2 were already adhering to a specific dietary plan. If the 3-2-1-G0! Project was repeated, the athletes would like to be informed on social media (27 %), or by their coaches (23 %). It was also suggested that the pre-Games promotion should be stepped up (n = 28; 58 %). A large majority welcomed the idea of having the 3-2-1-G0! project at future competitions (n = 36; 75 %) and stated they would use the 3-2-1-G0! education material if available at venues other than that of the Canada Games (Figure 2).

Table 2. Sports included in the study.

<table>
<thead>
<tr>
<th>Sports</th>
<th>Number of athletes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athletics</td>
<td>8</td>
</tr>
<tr>
<td>Basketball</td>
<td>6</td>
</tr>
<tr>
<td>Cycling and mountain biking</td>
<td>6</td>
</tr>
<tr>
<td>Fencing</td>
<td>4</td>
</tr>
<tr>
<td>Rowing</td>
<td>16</td>
</tr>
<tr>
<td>Swimming</td>
<td>4</td>
</tr>
<tr>
<td>Volleyball and beach volleyball</td>
<td>4</td>
</tr>
</tbody>
</table>

DISCUSSION

This article aims at evaluating the 3-2-1-G0! project that guides athletes towards better food choices during a sports event. The implementation process of the project referred to the Intervention Mapping because it is evidenced-based and iterative. The project consisted of environmental components to support and facilitate food choices when selecting meals and snacks at the cafeteria, and of a variety of individual components with coaches and their athletes.

The food policy supported availability of the foods with high nutritional density sought by athletes. Although literature on food policy implementation and impact is scarce, Cohen et al. (2000) revealed that greater product availability tangibly influences the attitudes and beliefs of individuals because, when healthful products are available in large quantities, the message perceived is that the situation is normal, appropriate, acceptable, and safe. Similarly, the food policy and the education material (posters and online nutrition tips) represented facilitating factors that, as described by Green and Kreuter (2005), facilitated the performance of an individual action. In this case, it consisted of acquiring new nutritional knowledge and adopting better food choices.
While our process banked heavily on environmental support in the food service, on the web, and through a press conference, the promotional aspect of these components proved less successful. The athletes and coaches would have benefited from receiving some training on the poster's contents upon arriving at the athletes' village or via a presentation on the website. Indeed, the athletes suggesting an improvement to the 3-2-1-GO! Project would have wanted to have been informed prior to the Games and via different means of communication aimed directly at them (social media, e-mail, website, etc.). Cohen et al. (2000) highlighted the importance of using a variety of information and promotional means in an attempt to positively influence individuals to adopt the desired behavior. An information booth at the cafeteria's entrance would also have been a good idea (Beaulieu and Godin, 2012).

Even though it was promoted by Twitter and Facebook, the small number of people who viewed the nutrition tips on the Canada Games website was a sign that adding a tab on the website's homepage leading directly to the tips would have facilitated access and increased traffic. However, the average time spent on this section of the website was 4 min, 15 s, which shows the high level of interest of visitors, as interpreted by the Games' communications staff.

As in the work of Torres-McGehee et al. (2012), most of the coaches in our study held the belief that optimal diet improved athletic performance. In addition, the coaches who felt that they had a higher level of nutritional knowledge were more focused on their athletes' diet during competitions. This finding confirms those of Zinn et al. (2006), who observed that the coaches who provided advice to their athletes had greater knowledge than those who did not. Moreover, we deem that the median result on the coach knowledge test (63.6%) is inadequate; several studies yielded similar results (Torres-McGehee, 2012; Juzwiak and Ancona-Lopez, 2004; Smith-Rockwell et al., 2001; Zinn, 2006). This discrepancy in results might be accounted for by the recent and growing presence of registered dieticians in the world of sports. The population targeted by Torres-McGehee et al. (2012) that is, the university environment might also have had enhanced access to registered dieticians, since they frequently teach in these institutions. Since our results indicate that very few coaches received the information document (28.9%), but that those who did read it and found it relevant, it would have been beneficial to have provided a short information session on the 3-2-1-GO! poster when the athletes arrived. Eighty-four percent of those who did not use the poster claimed that they already had the required knowledge and/or a dietary routine for competing. Since Torres-McGehee et al. (2012) observed that 91% of athletes had inadequate knowledge of nutrition; some doubt persists as to whether our respondents were really able to make the best food choices. On the other hand, 75% of coaches provided nutritional information to their athletes. That highlights the theory of Green and Kreuter (2005), who defined reinforcing factors as influencing the behavior of individuals. Indeed, coaches have considerable influence because young athletes interpret what their coaches say as being truthful, effective, and beneficial for their athletic performance (Fédération des Acteurs en Promotion de la Santé, 2009). Consequently, coaches must be adequately equipped with knowledge about nutrition in order to properly guide the choices of their athletes, justifying the environmental component of any educational program aimed at athletes.

All in all, the 3-2-1-GO! project was the first intervention
targeting food selection among competing athletes. The intervention was able to demonstrate its relevance and importance, since the respondents showed an interest in seeing the components used at subsequent sports events. There are overall benefits associated with using three different data-collection sources for the intervention because each can complement the other and lead to more comprehensive results. The limitations are that we recruited a limited athlete sample, there might have been desirability bias during the interviews, and we could have delved deeper into the athletes’ understanding of the poster’s content.

CONCLUSION

The food policy developed during the 2013 Games influenced the Canada Games Council with respect to their own creation of a food policy, which should be followed in all future editions. Given the very high level of satisfaction achieved with athletes and coaches with respect to the nutritional quality of the food served at the cafeteria, we hope that the organizers of subsequent editions will maintain a structure as presented in the appendix that advocates selecting foods with high nutritional value that are better suited to enhance performance.

With respect to the comments and observations, we can conclude that the 3-2-1-G0! project would have improved the knowledge level of the athletes and coaches. We trust that this knowledge would translate into optimal dietary practices for future sports events.

The 3-2-1-G0! poster content was revised and enhanced so as to enable its dissemination within the active population outside of the context of the Games. Indeed, organizations in the governmental, institutional, school, and sports environments are already using and promoting it.

RECOMMENDATIONS

Based on the findings on this project, it is recommended that:

A food policy serves as a guide for planning food purchases, preparation, and service.

The enhancement with regards to the advertisement and promotion of the educational material occurs by using more social media.

The educational material reaches the athletes before the competitions so they can implement and familiarize themselves with new food behaviors during their trainings.

Conflict of Interests

The authors have not declared any conflict of interests.

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