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2 **Commentary; Snap-N-Send: A Valid and Reliable Method for Assessing the**  
3 **Energy Intake of Elite Adolescent Athletes**  
4

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41 reliable method for assessing the energy intake of elite adolescent athletes. *Eur J Sport Sci*, 17, pp.  
42 1044-1055.

43  
44 Diet is an ever-changing, poorly characterised and multifaceted phenomenon. Consequently,  
45 traditional dietary assessment methods demonstrate considerable random intra- and inter-individual  
46 day-to-day variation and systematic over- or under-reporting bias (errors of reliability and validity;  
47 Beaton et al. 1997; Freedman et al. 2015) across populations (Pérez-Rodrigo et al. 2015). Expressed  
48 practically, true assessments of energy intake are misrepresented by hundreds of calories per day  
49 (Archer et al. 2016), erroneously informing medical conclusions (Schoenfeld & Ioannidis 2013),  
50 media claims (Archer, Pavea & Lavie 2015) and national dietary guidelines (Chowdhury et al.  
51 2014). Ultimately, the enormous potential of nutrition research to drive national health, patient  
52 welfare and public service (Dhurandhar et al. 2015), urgently necessitates, and ethically obligates,  
53 the valid assessment of diet within all dietetic output.

54  
55 Technological advances have enabled development of a new generation of electronic dietary intake  
56 assessments (e-DIA; Rollo et al. 2016). E-DIA support previously unachievable assessment  
57 ideologies, such as ecological momentary assessment (EMA; Hand & Perzynski 2016), allowing for  
58 the rapid collection, management and storage of dietary information as it occurs in the habitual  
59 environment of participants (Gemming et al. 2015). Nonetheless, many objective e-DIA remain  
60 limited by their poor accessibility (i.e. expense) and inability to translate into actual dietary or  
61 energy intakes (Rollo et al. 2016). Such methods require further development (Rollo et al. 2016)  
62 and robust validation (Kirkpatrick et al. 2016) before their measurement sensitivity can be  
63 confirmed. Alternatively, self-reported e-DIA are highly accessible, providing enhanced validity  
64 over traditional approaches (Kirkpatrick & Collins 2016). Nevertheless, such methods are still  
65 subject to the considerable measurement error that confounds traditional self-report dietary  
66 assessment; evidently, a new and improved approach is required.

67  
68 In light of these limitations, we propose a novel behavioural approach within the valid assessment  
69 of diet. This approach recasts self-report dietary assessment as both potentially valid and reliable  
70 (Dhurandhar et al. 2015), allowing for possibly unique distinction between methodological and  
71 behavioural (Maurer et al. 2006) measurement error. Methodological measurement error is inherent  
72 within the innate design of a dietary assessment tool. For example, the finite food items listed by a  
73 food frequency questionnaire (FFQ), the recall bias within memory-based assessment methods (M-  
74 BMs; Archer, Pavea & Lavie 2015), or ‘estimation’ involved within an estimated food diary

75 (Thompson, 2008). Such dietary assessment tools cannot be absent of methodological measurement  
76 error even when completed correctly by a behaviourally adhered participant. Alternatively,  
77 behavioural measurement error emerges from poor participant ‘capability’ and/or ‘motivation’  
78 (Patterson et al., 2013) to complete any dietary assessment in exact accordance with the method  
79 design, for the entire recording period. For example, poor literacy skills might affect the ‘capability’  
80 of an individual to comprehend the questions within a FFQ, whereas, poor ‘motivation’ might result  
81 in the completion of a weighed food diary via estimation, rather than actually weighing dietary  
82 consumption as designed (Thompson, 2008). It is now clear that methodological measurement error  
83 is the sole focus of current dietary assessment critique (Archer et al. 2016), research (Rollo et al.  
84 2016) and design innovation (Thompson et al. 2010). However, whereas methodological error can  
85 be attenuated by appropriate dietary assessment tool selection (Thompson et al. 2015); behavioural  
86 error requires unique, and oft over-looked, addressment.

87

88 Leading behaviour change science, as summarised by the Behaviour Change Wheel (BCW; Michie,  
89 Atkins and West, 2014), can be used to define population-specific behavioural barriers to the  
90 accurate recording of diet; attenuating, if not entirely eradicating, behavioural measurement error.  
91 The Capability, Opportunity, Motivation – Behaviour model (COM-B) outlines how to effectively  
92 change the desired behaviour, through nine intervention functions and seven categories of policy.  
93 The systematic, theoretical and applied nature of the BCW, summarised into eight easy-to-  
94 understand implementation steps, makes it an outstanding and pragmatic choice to help achieve  
95 valid dietary assessment. In this regard, we have recently validated a behavioural approach within a  
96 challenging population of elite adolescent athletes. Forty-seven behaviour change techniques  
97 (BCTs) were identified and delivered across six intervention domains and five categories of policy  
98 to over-determine correct and habitual adherence to real-time protocols (EMA) utilising an  
99 innovative method (‘Snap-N-Send’; Costello et al., 2017). Findings strongly evidence the  
100 importance of deploying comprehensive behaviour change science alongside innovative technology  
101 to secure improved adherence to real-time protocols and more valid self-reported dietary  
102 assessment.

103

104 Subsequently, a behavioural approach can be used to prevent complex biases, often accepted as  
105 innate (Maurer et al. 2006) shortcomings within self-report dietary research. By ensuring, rather  
106 than assuming, that participants are both behaviourally ‘capable’ and ‘motivated’ to record what  
107 they consume, social desirability and reactivity bias can be attenuated, if not completely prevented.  
108 Furthermore, a behavioural approach which confirms high participant adherence to real-time

109 assessment protocols (EMA) can also attenuate, if not theoretically prevent, the extensive memory-  
110 based bias (Schwarz, 2004) apparent within epidemiological research (Archer, Pavea & Lavie  
111 2015). Additionally, increased participant ‘capability’ and/or ‘motivation’ most likely explains why  
112 many innovative e-DIA now report improved validity and reliability (Rollo et al. 2016; Costello et  
113 al., 2017) over traditional, often laborious self-report methods (Thompson, 2008). Ultimately,  
114 further successful attenuation of measurement error within dietary assessment hinges upon effective  
115 deployment of primary behaviour change science into the design and delivery of innovative or  
116 existing dietary intake assessment.

117

118 To conclude, diet is the product of dynamic behavioural and environmental exposure, which  
119 presents unique challenges for methodological design and valid assessment. Left unattended, this  
120 dynamism produces substantial methodological and behavioural measurement error, which  
121 undermines confidence in assessment outcomes. Although there have been improvements in the  
122 execution of dietary assessments (Rollo et al. 2016), these have been insufficient to offset calls to  
123 abandon self-report assessment altogether (Archer et al. 2016). New eclectic models of behaviour  
124 change (e.g. COM-B) are now available to guide the design of bespoke instruments that address  
125 behaviours that impede accurate dietary reporting. This new scientific domain represents an original  
126 and effective approach to reduce and even prevent dietary assessment measurement error. Using  
127 this approach effectively, signals a paradigm shift in expectations for instrument design and  
128 implementation within the valid assessment of diet.

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