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