

## **INVESTIGATION ON PRACTICES OF SUPPLEMENTS AS PERFORMANCE ENHANCING SUBSTANCES AMONG KENYAN ELITE MIDDLE AND LONG DISTANCE RUNNERS**

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### **Abstract**

Research has demonstrated that elite athletes use supplements to enhance performance. The purpose of the study was to assess the current practices on the use of banned substances among elite athletes. The study hypothesised that there would be no significant difference in the use of supplements by Kenyan elite middle and long distance runners. This study was guided by the descriptive survey research design. The target population comprised of 1960 elite athletes registered with Athletics Kenya (AK), coaches and managers. Stratified sampling technique gave 600 participants based on age and gender. Data was collected using a questionnaire that featured WADA Code 2011. ANOVA and Independent T-test determined statistical significance level at  $p < 0.05$ . Results revealed no statistically significant difference in the use of supplements by Kenyan elite distance athletes. This study recommends further research regarding experience, gender and current practices of banned substances among elite middle and long distance athletes.

**Keywords:** Elite, Performance, Practices, Supplements, Substances

### **1. INTRODUCTION**

Since Kenya's first unsuccessful attempt at winning an Olympics medal in 1956 in Melbourne, Australia, the country has managed to haul in a respectable Olympic 100 medals over the years, managed a top 10 finish during the 1972 Munich games, and number 13 in Seoul and Beijing Olympics in 1988 and 2008 respectively. During the last Olympics in Rio de Janeiro, Kenya managed to finish at position 15 with a total haul of 13 medals, its second best ever medal haul at the Olympic Games. Despite Kenya's success in international competitions in particularly, the international mass media has on several occasions insinuated that its success has been assisted by

use of illegal performance enhancing substances  
<https://www.theguardian.com/sport/2013/oct/30/kenya-wada-doping-athletes>

Despite the Kenyan government launching the Anti-doping Agency of Kenya task force to help in investigating and curbing the Doping menace, Kenyan athletes have been found culpable of doping while a number are still missing on the online Anti-Doping Database (ADDB). The true frequency of doping tends to be more widespread than anti-doping control data (Lippi et al., 2008). World Anti-Doping Agency(WADA) was established on 10 November 1999 (<http://www.wada-ama.org> 2018) as an independent doping control body to fulfil the functions of education and testing worldwide; with a mission of promoting and coordinating the fight against doping in sport in all forms at international level (<http://www.wada-ama.org> 2018). After the development of WADA, various rules and regulations have been formulated to curb the menace of Doping, amongst them is the WADA code (Savulescu, Froddy, and Clayton, 2004). Various countries across the world have also established their own rules and regulations in accordance with the WADA Code to regulate doping. In South Africa, for example, the South African Institute of Drug-Free Sport Act 14 of 1997 was enacted (Maughan 2005).

Doping, or the use of drugs, has been used by Olympic athletes to enhance performance for over 100 years (Kremenik, Onodera, Nagao, Yuzuki, & Yonetani, 2006). The Greek Olympians are believed to have used substances such as Dried Figs, mushrooms and strychnine to perform better as early as BC 776 (Andrén-Sandberg, 2016). The dietary supplement health and education act 1994, DSHEA defines supplement as a product (other than Tobacco) intended to supplement the diet that bears or contains one or more of the following ingredients; a vitamin, a mineral, herb or other botanical, an amino acid, a dietary substance for use by man to supplement the diet by increasing the total dietary intake or concentrate a metabolic constituent or combination of ingredients. They may also be synthetic copies of naturally occurring substances. Unlike drugs, no government approval is required to sell supplements and manufacturers confirm safety. Herein lies the danger for athletes as the manufacturer may use chemicals or substances that are on WADA list of banned substances, thereby compromising Athletes position in sports. Due to commercialization of supplements, most manufacturers may provide false information i.e. 'do not contain chemical preservatives, It is an alternative remedy for detoxifying the body of the toxic waste and supplementing it with the essential vitamin, minerals, enzymes, amino acids and probate natural products for living healthy and balanced life. The first documented doping case occurred at the 1904 Summer Olympics in St. Louis when British Born American marathoner, Tom Hicks was given small bits of strychnine with Brandy and a little egg-white by his coach, Charles Lucas (Mallon 2004). In the same year, mixtures of strychnine, heroin, cocaine and caffeine became very popular and were widely used by cyclists and lacrosse players in order to prevent fatigue and hunger (Ibid Historical Timeline, 2018). A study on herbal supplement found that many products were low quality and did not contain active ingredients and claimed a third contained unlisted substances (Subramanyan, 2013). Research also demonstrates that 78% of samples in supplements contained animal DNA that was not identified on the product labels (Zhang, Woods, Bratbach & Armstrong 2012).

A review indicated rising incidences of liver injury from use of herbal and dietary supplements especially those with steroids, green tea extracts or multiple ingredients (Zhang et al, 2012). In some botanical products, unclear ingredients were used to increase the bulk of the product and reduce the cost of manufacturing potentially violating anti-doping regulations and cultural limitations. However, in Kenya there is no regulatory body that controls the manufacturing, distribution and use of supplements among the general public. Therefore, supplements are often accessed over the counter without prescription, hence posing danger of circumventing doping regulation.

Use of herbal remedies has been used since time immemorial for various reasons. However, in Kenya there is limited research on chemical compositions of these remedies hence their use may place athletes at risk of violating anti-doping rule.

Kamenju, Mwisukha, & Rintaugu (2016) investigated on Kenya teacher trainee athletes' awareness of selected performance-enhancing substances and their effects on sports performance. The study targeted 422 (n=211 male and n=211 female trainees). The findings revealed approximately 49.3% of athletes were aware of the WADA code. About 43.3% were not aware of its existence. Approximately, 48.0% admitted having knowledge of the regulations as stipulated while 42.7% were not aware of it. In addition, the study revealed that the athletes were not fully aware of effects of selected substances. About 67.8%, 47.0%, 51.9%, 43.6% and 51.5% reported that miraa (khat), marijuana, caffeine, anabolic steroids and cocaine respectively did not enhance sports performance. Therefore, it was recommended that a comprehensive anti-doping agency strategy at primary, secondary, and colleges should be adopted in order to create awareness of doping. Further research on the level of awareness should be conducted on athletes' personnel of collegiate teams. This research will establish the effectiveness of the doping content taught to the teacher trainees. Since this study was on athletes' awareness, there was a gap that necessitated the current study on practice behaviour of elite distance athletes.

Chebet (2014), conducted a study on knowledge, attitude and practices of doping among elite middle and long-distance runners in Kenya. The study was a cross-sectional survey involving 427 athletes. Data collected was based on self-reports. Results showed overall knowledge of doping was 46.4%, approximately 82.3% of Kenya athletes had negative attitude towards doping with varying degrees and only 17.7% indicated a positive attitude.

Tabata, Kamata & Sato (2020) investigated the use of nutritional supplements (NS) by elite Japanese track and field athletes (TF). The study targeted 574 Japanese track and field athletes (under 20 years). Senior elite athletes (299) had participated in international competitions during the period between 2013 and 2018. Results indicated a prevalence (63.9%) of nutritional supplement use where the mean number of NS products per athlete was 1.4. Chi square revealed a higher prevalence in women (69.2%) than in men (59.9%) ( $p=0.018$ ). The prevalence was significantly higher in senior athletes (68.9%) than in junior athletes (58.9%) ( $p=0.012$ ). Further, prevalence of NS use was higher in long-distance runners (52.3%) and throwers (49.2%) than other disciplines ( $p<0.001$ ). In conclusion, approximately, two thirds of elite Japanese track and field athletes reported the use of NS. NS practices varied by gender, age and discipline. The study revealed that

the use of nutritional supplements is widespread among athletes. Therefore, understanding nutritional supplements practices is crucial.

Muwonge, Zavuga, Kabenge (2015) conducted a cross – sectional study on doping, knowledge, attitude and practices involving 384 professional athletes Ugandan athletes. The athletes represented four contact team sports (basketball, football, handball, and rugby) as well as two individual sports (athletics and cycling). Approximately 60% reported familiarity with information on doping. About 41.9% obtained the information from their colleagues, 29.7% from individual or team coaches and 15.6% obtained from the media. On knowledge, 80% of the participants could not define doping properly. Overall, mean (PEAS- a measure of doping attitudes) for all study participants was  $39.8 \pm 14.8$ . The female athletes measured PEAS:  $41.1 \pm 15.1$ . Athletes with prior doping history scored PEAS:  $44.1 \pm 15.1$  while athletes from athletics measured PEAS:  $56.6 \pm 17.4$ . Regarding behaviours or practices, the study indicated that 9.3% had been offered a doping (probably to consume) and 3.9% of the athletes acknowledged recent use.

A study by Salgalo, Lollo & Chacon – Mikahil (2014) interviewed 817 (671 male and 146 female) volunteers from four road races in the Brazilian calendar. The runners had a mean age of  $37.9 \pm 12.4$  years. Findings of the study revealed that approximately 28.33% reported having used some type of supplements to increase stamina and improve performance. The probability of consuming dietary supplements increased about 4.67 times when runners were guided by their coaches. Further, the study revealed that consumption of supplements was highly correlated ( $r=0.97$ ) with weekly running distance. Similarly, consumption of supplements was highly correlated ( $r=0.86$ ) with the number of years which a sport had been practiced. Since most consumed supplements were carbohydrates (52.17%), vitamins (28.70%) and proteins (13.48%), the study recommends a balanced diet which should be able to meet the needs of physically active athletes. In conclusion, the longer the athlete had practiced the sport, the higher the training volume and the greater the intake of supplements.

## 2. MATERIALS AND METHODS

This study adopted a descriptive survey research design to investigate the problem. The survey took a descriptive approach since the research aimed at establishing facts about practices of performance enhancing substances amongst athletes in Kenya. The main characteristic of this approach is that the researcher had no control over the variables but rather could only report what was happening or what had happened before (Blanche, Blanche, Durrheim & Painter, 2006). Independent variables will included age and gender and experience. Dependent variable was practice of supplements, and access to material on performance enhancement. Practice was measured in terms of occurrence of any of the eight offences stipulated in the WADA code 2011 as reported and observed by the participants. The study was carried out in parts of Kenya with a high concentration of elite athletes and athlete training camps. The areas identified for the study included: Kapsabet, Mosoriot and Kericho training camps.

The study targeted 1960 elite athletes in Kenya currently registered with Athletics Kenya (Athletics Kenya, 2011), managers, coaches and event organizers. Stratified sampling technique was used to

generate the sample of 600 participants. However, 239 (male 135, 56.5%; female 104, 43.5%) participated in the study. Stratification was based on gender and age. This ensured that the sample selected per category was proportionate to their representation in the original population as shown in table 1.1. The athletes were divided into age strata of Under 18 years, 18-30 years and above 30 years of age. The sample population was calculated using the following formula.

$$\text{Sample Population (n)} = \frac{\text{size of entire strata}}{\text{Population size (N)}} \times \text{layers}$$

$$n = \frac{600}{1960} \times \text{layers}$$

The sample population was divided into the following groups.

**Table 1.1: Strata sample Size**

Age Group	Men	Women	Sample size	
			Men	Women
Under 18	222	195	68	60
18-30	555	425	170	130
Above 35	265	298	81	91
<b>Total</b>	<b>1960</b>		<b>600</b>	

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The questionnaire was based on practices regarding use of performance enhancing substances as stipulated in the WADA Code of 2011. To be reliable, a survey questionnaire must be answered by respondents the same way each time. In other words, the procedure must yield the same results on repeated trials (Weisberg, Krosnick & Bowen, 1989). The test-retest method was used. This was assessed by comparing responses given in one pre-test to those given to another. This eventually enabled the researchers to satisfactorily draw conclusions and make inferences that would be generalized and ascertained the reliability of the tool of research. A questionnaire's validity is determined by how well it measures the concept that it is intended to measure. In other words, it refers to the degree to which the study itself accurately reflects or assesses the specific concept that the research is attempting to measure (Campell & Stanley, 1996). In this research, validity was ensured by first comparing answers given on one question with answers given in other questions measuring the same concept by the same respondent (different sets of questions were set on same concepts). Again, validity was determined by comparing responses to questions that asked for opposite answers.

### 3. RESULTS AND DISCUSSION

Many study participants reported not to have ever used nutritional supplements to improve performance (75.7%) as demonstrated in table 1.1. Yet, Tabata, Yamasawa & Sato, (2020) conclude that the use of Nutritional Supplements (NS) was widespread among athletes as early as BC 776 (Andien – Sandberg (2016). Similarly, the use of NS poses serious issues of health damage of unintended Anti – Doping Rule Violations due to ingestion of contaminated NS in sports.

Therefore, understanding, NS practices by athletes is crucial. Similarly, Chebet (2014) revealed 21.4% of athletes having admitted using herbal and nutritional supplements. This study suggests further research on practices or use of supplements by athletes. Approximately, 11.3% admitted to have heard about a local chemist, medical practitioner or sports agent supplying performance drugs. This is supported by Muwonge, Zavuga & Kabenge, (2015) whose study concluded that a considerable percentage of athletes seem to have reported familiarity with information on doping

**Table 1.1. The Association of Athletes' Races with Their Practice on Performance Enhancing Substances Use**

Practices	Races						Total N	Total %	P value	
	3000 and below		Above 3000m-5000m		Above 5000m					
	N	%	N	%	N	%				
Have you ever used nutrition supplements to improve performance	Yes	41	17.2%	6	2.5%	11	4.6%	58	24.3%	.356
	No	112	46.9%	32	13.4%	37	15.5%	181	75.7%	
Used traditional herbs to improve performance	Yes	14	5.9%	0	0.0%	2	0.8%	16	6.7%	.096
	No	139	58.2%	38	15.9%	46	19.2%	223	93.3%	
Used any other performance enhancing substance to improve sports performance	Yes	7	2.9%	0	0.0%	1	0.4%	8	3.3%	.322
	No	146	61.1%	38	15.9%	47	19.7%	231	96.7%	
If I have been given performance enhancing substance by coach, physio or team doctor	Yes	7	2.9%	0	0.0%	2	0.8%	9	3.8%	.410
	No	146	61.1%	38	15.9%	46	19.2%	230	96.2%	
Have you heard a local chemist, medical practitioner or sports agents supplying performance enhancing drugs	Yes	24	10.0%	1	0.4%	2	0.8%	27	11.3%	.016*
	No	129	54.0%	37	15.5%	46	19.2%	212	88.7%	

The results in table 1.1 indicate that as for races 3000metres and below, 17.2% admitted having used nutritional supplements to improve performance. Approximately, 61.1% did not admit having used any other substance given by their coaches, physiotherapists and team doctors. This is supported by Kremeni, Onodera, Nagao & Yonetani (2006), Chebet (2014), Muwonge, Zavuga & Kabenge (2015), Andrien – Sandberg (2016), Tabata, Kamata and Sato (2020). Although fewer (2.9%) athletes seem to have admitted taking nutritional supplements after having been given by their coaches, physiotherapists or their team doctors for the purpose of enhancing performance, this



study recommends that Athletics Kenya (AK) should organize seminars in order to disseminate information on doping education among distance athletes.

Similarly, (46.9%) denied ever using nutritional supplements to enhance performance. These results concur with the study by Muwonge, Zavuga & Kabenge (2015) who concluded that 80% of professional Ugandan athletes could not correctly define doping. Further, only 9.3% had been offered a doping agent.

Regarding races between 3000metres and 5000metres, approximately 2.5% of the athletes admitted ever having used nutritional supplements. The rest of the statements such as using other substances to enhance performance, given by coach, physio or team doctor and having heard from a local chemist, medical practitioner and sports agents attracted 0.0%, 0.0% and 0.4% of the study participants respectively. Yet studies by Kremen, Onodera & Yonetani (2006) reveals that the use of drugs to enhance performance has been documented for over 100 years. Similarly, the study by Andren – Sandberg (2016) concludes that during ancient times, as early as BC 776 (the first recorded Olympic Games) athletes used substances such as dried figs, mushrooms, strychnine to perform better in Olympics. Similarly, another study by Subramanian (2013) found revealed that many herbal supplements were used although evidence showed that they were of low quality.

Generally, athletes who participated in races above 5000 metres admitted (4.6%) ever having used nutritional supplements to improve performance. Those athletes who used any other performance enhancing substance contributed to 0.4%. On the contrary, the most prevalent statement where athletes did not admit (19.7%) having used nutritional supplements was cited in using any other supplements to improve performance. Whereas the less prevalent statement where the study participants did not admit (15.5%) was when the athletes were asked if they had ever used nutritional supplements to improve performance.

Overall, the null hypothesis that there would be no significant differences in the use of performance enhancing substances among athletes specialized in different races, gender and experience was not rejected. The descriptive statistics associated with use of performance enhancing substances across the three race groups are reported in Table 1.2. Results indicate that races above 5000m group was associated with the numerically smallest mean ( $16.06 \pm 3.15$ ) in the use of performance enhancing substances. On the other hand, races between 3000m and 5000m group were associated with the numerically highest mean towards nutritional supplements ( $17.08 \pm 3.02$ ). This is consistent with the study by Muwonge, Zavuga & Kabenge (2015) which revealed a mean measure (PEAS) of  $56.6 \pm 17.4$  scored by athletes from athletics although there was a great difference between the mean values in both studies. In order to test the hypothesis that the athletes participating in different races had an effect on the use of performance enhancing substances between- groups ANOVA was performed, while independent t-test was used to check practice differences in gender and experience among athletes. Prior to conducting the ANOVA and t-test, the assumption of normality was evaluated and determined to be satisfied as the distribution of the three groups were associated with skew and kurtosis, less than  $-1.0$  and  $1.0$  respectively. The independent between- group ANOVA and t-tests yielded non- statistically significantly effects, thus, the null hypothesis of no significant differences in use of performance enhancing substances among athletes of different races, gender and experience not rejected as observed in table **table 1.2**.

**Table 1.2: Analysis by ANOVA on Practice on Performance Enhancing Substances use Among Athletes Specialized in Different Races**

Races	N	Mean	Std. Deviation	Std. Error	Df	F	Sig
3000 and below	153	16.84	3.626	.293	2	1.167	.313
Above 3000m-38		17.08	3.026	.491			
5000m							
Above 5000m	48	16.06	3.152	.455			
Total	239	16.72	3.450	.223			

The independent T-test was used to analyse data on experience and gender of the study participants. Results are shown in Table 1.3.

**Table 1.3: Independent T-test on Differences in Practice of Performance Enhancing Substances use Based on Athletes' Experience and Gender**

Experience	N	Mean	Std. Deviation	Std. Error	Df		Sig
						T	
10 years and below	219	16.79	3.385	.229	237	1.111	.268
11 years and above	20	15.90	4.103	.917			
Total	239	16.72	3.450	.223			
<b>Gender</b>							
Male	135	16.52	3.213	.277	237	1.027	.305
Female	104	16.98	3.734	.366			
Total	239	16.72	3.450	.223			

The results in table 1.3 indicate analysis using the independent T-test on differences in practice of performance enhancing substance use based on experience and gender as independent variables of the study. Experience refers to practicing a sport over a certain period of time. Analysis of data has revealed that a majority (N=219, Mean=16.79, T=1.11,  $p > .268$ ) of the study participants had practiced their various races for ten (10) years and below. Fewer (N=20, Mean=15.90, T=1.027),  $p > .305$ ) had participated in their races for a minimum of eleven years and above. Apparently, there were no marked differences in the mean values between the two periods of experience in practicing the sport. While this article suggests further research based on experience as it determines consumption of supplements, a study by Salgado, Lollo & Chacon-Mikahil (2014) has concluded that consumption of supplements was strongly correlated ( $r=0.97$ ) with weekly running distance. Further, the study also revealed that the consumption of supplements was highly correlated ( $r=0.86$ ) with the number of years the sport had been practiced. The implication is that the longer the athlete practices the sport, the higher the training volume and the greater the intake of supplements.



The independent T-test analysed the use of performance enhancing substances based on gender (N=135 male, N=104 female). Table 1.3 has shown that the mean values for male and female athletes were 16.52 and 16.98 respectively. These results are consistent with the study by Muwonge, Zuvuga & Kabenge (2015) that scored a mean value of PEAS  $41.1 \pm 15.1$  for female athletes professional Ugandan athletes. However, the study did not indicate the results for the male professional Ugandan athletes. There the current study suggests further research involving gender as an independent variable and supplements as dependent variable. These mean values followed the same trend as in the number of years athletes had practiced the sport. Hence, there were no marked differences. Overall, the  $T=1.027$  and had a significance level of  $p > .305$  thereby not rejecting the null hypothesis.

#### 4. RECOMMENDATIONS AND CONCLUSION

The most consumed supplements seem to contain carbohydrates, proteins and vitamins. Therefore, this study recommends a balanced diet which should be able to meet the needs of physically active athletes. Further research in practices of athletes on the use of supplements based on races (middle and long distances), experience of athletes and gender is also recommended. In conclusion, the longer the athlete practices a given sport, the higher the training volume and the greater the intake of supplements.

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#### REFERENCES

- Andrén-Sandberg, A. (2016). The History of Doping and Antidoping: A systematic collection of published scientific literature, (January), 1–136.(Online)Available: <http://www.rf.se/globalassets/riksidrottsforbundet-rf-antidoping/dokument/forskning-och-statistik/the-anti-doping-library-anti-doping-history.pdf>
- Athletics Kenya (2011).
- Blanche, M.T., Blanche, M.J.T., Durrheim, K., & Painter, D. (2006). Research in practice: applied methods for the social sciences. Juta and Company Ltd.
- Campbell, D.T. & Stanley, J.C. (1996). Experimental and quasi – experimental designs for research, 1<sup>st</sup> Edition, AMAZON
- Chebet S. (2014). Education of Knowledge, Attitude and Practices of Doping among Elite middle and long-distance runners in Kenya. (Online) Available: <http://ir-library.ku.ac.ke/handle/123456789/1896>
- (Online) Available: <https://www.thequaedian.com/sport/2013/oct/kenya-wada-doping-athletics>
- (Online) Available: <http://www.wada.ama.org> 2018
- Ibid Historical Timeline – Sports and Drugs - ProCon.org. (accessed June 11, 2018)
- Kremeni, M., Onodera, S., Nagao, M., Yuzuki, P. & Yonetani, S. (2006).. A historical timeline of doping in the Olympics (part 1 1896 – 1960). *Kawasaki Journal of Medical Welfare* Vol 12. No1, 2006 19-25

- Lippi, G., Banfi, G., Franchini, M. & Guidi, G.C. (2008). New strategies for doping control. *Journal of Sports Sciences* 26(5) 441-5 DOI:10.1080/02640410701654556
- Maughan, R.J. (2005). Contamination of dietary supplements and positive drug tests in sport. *J Sports Sci.* 2005 Sept.
- Muwonge, H., Zavuga, R. & Kabenge, P.A. (2015). Doping knowledge, attitudes and practices of Ugandan athletes: a cross-sectional study, *Substance Abuse Treatment, prevention and Policy*, 10, Article number 37 (2015), (Online) Available: <https://doi.org/10.1186/s13011-015-0033-2>
- Salgado, V.V.J., Iollo, B.C.P., & Chacon – Mikahil, T.P.M. (2014). Dietary supplement usage and motivation in Brazilian road runners. *Journal of the International Society of Sport Nutrition*, 11, Article 41 (2014)
- Subramanian, R., Steven, G.N., Meghan, G. et al (2013). DNA barcoding detects contamination and substitution in American herbal products. *BMC Medicine* 11 Article number 222 (2013.)
- Tabala, S., Yamaswa, F., Torii, S., Manabe, T., Kamada, H., Namba, A., Kato, J., Kanako, H., Tahara, K., Tsukara, Y. & Sato, K. (2020). Use of nutritional supplements by elite Japanese track and field athletes. *J Int Soc Sports Nutr.* 2020; 17:38 doi: 10.1186/s12970-020-00370-9
- Kamenju, J.K., Mwisukha, A. & Rintaugu, G. (2016). Kenya teacher trainee athletes' awareness of selected performance-enhancing substances and their effects to sports performance. *Journal of Physical Education and Sports management*, December 2016, Vol. 3. No 2. Pp, 23-38 ISSN 2373-2156(Print). 2373-261(Online), Published by American Research Institute for Policy Development. DOI:10.15640/jpesm.v3n2azURL : (Online) Available: <http://doi.org/10.15640/jpesm.v3n2az>
- Weisberg, H.F., Krosnick, J.A. & Bowen, B.D. (1989). An introduction to survey research and data analysis (2<sup>nd</sup> ed.) Scott, Foresman & Co.
- Zhang, Y., Woods, R.M., Bratback, Z.S. & Armstrong, D.W. (2012) 1, 3- Dimethylamylamine (DMAA) in supplements and geranium products: natural or sympathetic (Online) Available: <https://doi.org/10.1002/dia.1368> *Drug Testing and Analysis*, Volume 4, issue 12