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Body Mass Index of North American Participants at the World Masters Games

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Abstract: WMG (World Masters Games) athletes have either pursued a physically active lifestyle for an extended period of time or have initiated exercise/sport in later life. This unique cohort of middle-aged to older-aged adults remains relatively uninvestigated with regards to various measures of health. With a need for multifaceted solutions to the obesity epidemic, investigating special populations such as those competing in sport at older ages may further the understanding of the nexus between aging, physical activity and obesity. This study aims to investigate the BMI (body mass index) of North American WMG competitors with respect to national health guidelines and demographics. An online survey was utilized to collect demographic information from athletes competing at the Sydney WMG. BMI was derived using the participant's height and body mass. A total of 928 (46.7% male, 53.3% female) participants from Canada and the United States (age: 52.6 ± 9.8 years) completed the survey. The top 5 sports in which participants competed were football (25.6%), track/field (15.4%), swimming (8.4%), volleyball (8.2%), and softball (7.8%). Female and male BMI (kg/m^2) across all sports were: > 30 (obese: 13.9%), 25-29.9 (overweight: 34.1%), 18.5-24.9 (normal: 50.3%), and <18.5 (underweight: 1.7%). Data indicated that BMI was a health risk factor for 13.9% of the participants and a developing risk factor for 34.1% of the participants. Analysis demonstrated a significantly reduced ($P < 0.05$) classification of obesity of the North American WMG competitors when compared to Canadian and United States national populations. It is believed that adherence to exercise improves indices of general health. A key index of health (obesity) is significantly lower in incidence for North American WMG competitors when compared to Canadian and US populations.

Key words: Masters athletes, masters games, BMI, obesity.

1. Introduction

The WMG (World Masters Games) is the largest international sporting competition in terms of participant numbers. In 2009, the SWMG (Sydney World Masters Games) attracted 28,089 competitors who represented 95 countries competing in 28 sports [1]. Previous research has examined the health of North American competitors [2], injury incidence in the lead up to the tournament [3] and motivations for competition [4]. Initial analysis of BMI (body mass index) [5-7] has shown promising trends, however, these athletes remain under investigated with regards to various measures of health.

Although the WMG have been in existence since 1985, there is limited scientific literature available on this unique cohort. With a need for multifaceted solutions to the obesity epidemic, investigating special populations such as those competing in sport at older ages may further the understanding of the nexus among aging, physical activity and obesity.

BMI is regarded as an important health characteristic that is recognized as a risk factor to

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health. The number of overweight and obese individuals has reached epidemic proportions globally. Excess body weight as measured via BMI has been shown to be associated with increased risk of conditions such diabetes, cardiovascular disease, high blood pressure, high cholesterol, and certain cancers [8]. Hence, the purpose of this study was to investigate the BMI of WMG competitors with respect to national health guidelines and demographics. This brief report focuses on North American participants and is a continuation of previous works with this cohort [2, 4-7].

2. Methods

Institutional approval was attained from the Bond University Human Research Ethics Committee, and organizational approval was attained from the WMG's organizing committee. Competitors provided informed consent electronically prior to enabling them access to the online research survey.

A cross-sectional, observational study was completed using an online web-based questionnaire (LimeSurvey, an open source survey application). Data collection included demographic data for participants such as height, body mass and age. BMI was derived from this self-reported data via calculation using the participants' height and body mass. The questionnaire was piloted on 70 non-participants following which only minor changes were made to medical terminology. The survey was activated for a total of four months.

The WMG's organizing committee stipulated that collection of research data attached to this study was to be gathered via online. Hence, all WMG's competitors who provided a valid email address were sent an invitation to participate in the study.

A total of 28,676 competitors representing 95 countries and competing in 28 sports took part in the WMG's. Of those who competed in the games, 24,528 electronically registered for the games. Those who electronically registered for the games were sent an invitation to participate in the study. A total of 8,072 consented to participate in the study and responded to the online survey; a response rate of 28.2% (Fig. 1). Of the aforementioned 8,072 participants, 928 (11.5%) were from Canada or the United States and are the focus of this report.

Statistical analyses were performed using SPSS statistical software package (Version 17.0, Chicago Illinois, USA). Normally distributed data were described using mean ± standard deviation, frequencies or percentages. Pearson chi-square tests were used to determine if statistical differences existed between genders and groups. A *P*-value was set a priori of < 0.05 to determine statistical significance.

3. Results

The top 5 countries by participation numbers were: Australia (74.9%), Canada (9.9%), New Zealand (4.6%), USA (3.3%), UK/Britain (2.2%). Table 1 provides details as to the participants of North America by gender and age. The top 5 sports participated in by North Americans were: football,

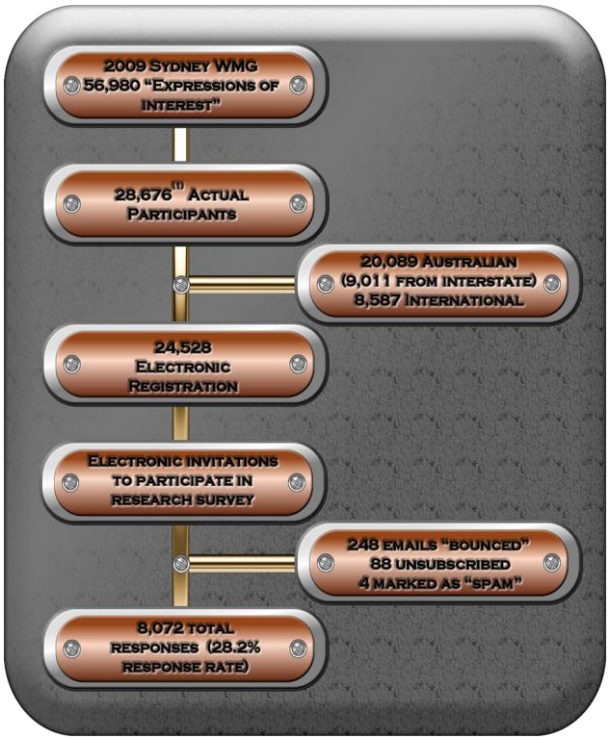

Fig. 1 2009 Sydney WMG survey process.

Table 1 WMG North American participants

	Participation	Age (years)
	N = 928	Mean ± SD
Total	100%	52.6 ± 9.8
Female	53.3%	50.2 ± 9.7
Male	46.7%	52.6 ± 9.1

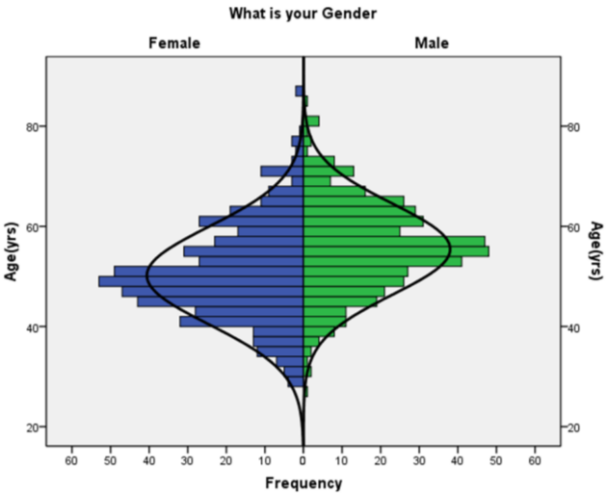

Fig. 2 WMG participation pyramid age by gender.

track/field, swimming, volleyball, and softball. Fig. 2 is a participant pyramid (age by gender) for the North American competitors. Table 2 provides BMI classifications as partitioned by sport and gender.

The Canadian incidence of obesity prevalence is 25.6% for the non-Hispanic white population aged 20-79 years, (data collected from 2007 to 2009) [9, 10]. The US incidence obesity prevalence is 33% for non-Hispanic white population aged 20-79 years, (data collected between 2007 and 2008) [9, 10]. Table 2 provides a statistical comparison (chi-square) of the masters athletes obesity prevalence with that reported in the general populations in Canada and the US. All sports (both genders) had a significantly lower percentage of obesity prevalence than the US population ($P < 0.05$). Football, track/field, swimming, and volleyball (both genders) also had a significantly lower prevalence of obesity than the Canadian population ($P < 0.05$).

BMI was a health risk factor for 13.9% of the participants and a developing risk factor for 34.1% of the participants. Of the top 5 participation sports, softball players exhibited the greatest incidence of

Table 2 Percent BMI Classification by Sport and Gender.

	Gender	BMI			
		< 18.5	18.5-24.9	25-29.9	> 30
All sports	M & F	1.7	50.3	34.1	13.9*,**
Football					
	M	0.0	44.8	41.4	13.8*,**
	F	3.7	65.4	19.8	11.1*,**
Track/field					
	M	1.4	0.0	93.2	5.5*,**
	F	0.0	75.0	21.4	3.6*,**
Swimming					
	M	0.0	40.0	50.0	10.0*,**
	F	4.5	47.7	38.6	9.2*,**
Volleyball					
	M	0.0	36.4	54.5	9.1*,**
	F	0.0	82.6	17.4	0.0*,**
Softball					
	M	0.0	12.0	64.0	24.0**
	F	0.0	42.5	30.0	27.5**

*$P < 0.05$, significantly lower than Canadian obesity prevalence;
**$P < 0.05$, significantly lower than U.S. obesity prevalence.

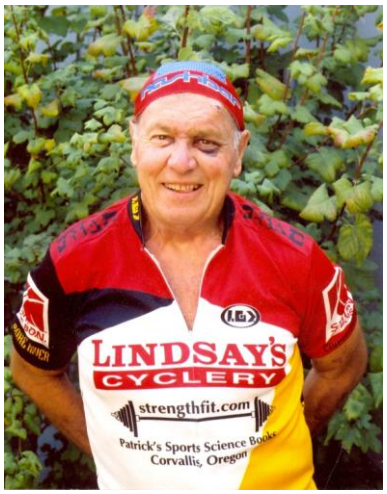

Fig. 3 Professor Emeritus John Patrick O'Shea "sporting a shiner" following an accident in a cycling time trial.

obesity which was comparable to that found in the general Canadian population.

4. Discussion

This study focused on masters athletes competing at the Sydney WMG. Masters athletes have either pursued a physically active lifestyle for an extended period of time or have initiated exercise/sport in later life. Sport competition and the associated exercise

adherence could be considered an "advanced form of physical activity". Regular participation in physical activity has been identified as the most significant health intervention strategy to help adults as well as mature adults maintain health and functional independence [11, 12]. Hence, this study attempted to address if advanced physical activity as expressed through masters competition and the associated exercise adherence could be beneficial with regards to BMI, a known index of health.

The results of this study suggest that BMI lies significantly more in the range considered as "normal" for North American WMG athletes when compared to population prevalence data of open age Canadians and US Americans. This indicates a significantly improved health in terms of one health risk factor (BMI) for North American WMG athletes when compared to open age North Americans. These very positive results are based upon a participant pool of 928 individuals who have engaged in sport for an extended period of time or have initiated exercise/sport in later life. Hence, the prescription of masters level competition to the recreational exerciser or sedentary individual must be approached with caution. Individuals could be advised to move from sedentary towards recreational exercisers; adhering to exercise on a regular basis and possibly employing basic principles of periodization [13]. Those who are currently recreational exercisers could be advised to adapt their current exercise programs to more of a sport training philosophy that employs periodization principles with yearly macro cycles [13]. Individuals in this phase of sport training could then focus on developing the necessary sports skills to participate in a given sport eventually leading to masters sport competition. While there is no assurance that any individual could rise to the level of an international masters athlete, it is possible that the process of pursuing competition level performance may provide the health related benefits expressed by the participants in this study.

When considering if health professionals should advise aging clients to pursue advanced physical activity through masters competition, one must evaluate the risk versus benefit. Specifically, is there an elevated injury risk associated with participating in masters competition and/or the associated exercise adherence related to training for competition? A recent study by Walsh et al. [14] focused on injury incidence of masters athletes competing in football sports (association football, touch football, and rugby union). Football sports are high-speed in nature and include frequent impacts with players and the ground. The results of Walsh's [14] study suggested that there was no age-related difference in injury classification type, location, incidence, time off work, or missed training when compared to younger athletes (< 50 years of age). Hence this study [14] lends support to the notion that the health related benefits of participation in masters competition may outweigh the potential injury risks.

It should be noted that the issue of causation must also be considered. Namely, the question of whether competing in masters sport promotes a healthy BMI or alternatively whether people who have a healthy BMI participate in masters sport by preference. Future longitudinal experimental investigations may resolve the issue of causation.

A potential limitation of this study relates to the fact that BMI is calculated by dividing an individual's mass by their height squared [15]. The ratio of whether an individual's mass is in proportion to height could potentially correlate with high levels of body fat, however, strictly speaking, they are measures of different constructs (i.e., BMI does not take into account tissues of lean mass and fat mass). On a population level, with a large subject sample, BMI is a valuable tool for estimating body mass. On an individual level and for certain specific populations [16], inaccuracies arise with correlating BMI with anthropometric body composition and thus the health implications of relatively high body fat mass. Despite BMI's limitations as an index for athletic populations

[16] and the propensity for an increase in muscle mass from adherence to sport, it was still hypothesized that the BMI of the WMG athletes would be significantly lower than the comparative general populations.

This report suggests a reduction in the prevalence of obesity for North American competitors participating in the WMG. Other reports [2-7, 14, 17] have examined the social, psychology, and health benefits of masters athletes, presumably resulting from their experience of competition and/or the exercise adherence related to training for competition. The results of the aforementioned reports suggest that indices of social, psychology and physical well-being are positively influenced via the experience of masters level competition.

A clear benefit of the preparation to compete in sport as a master level athlete relates to the ability to perform ADL (activities of daily living). The inability to perform ADLs is an indicator of physical disability [18]. Older adults who are unable to perform one or more ADLs are at greater risk of losing functional independence. It is estimated that 47.3% of adults aged 65-77 years are disabled and that this percentage climbs to over 70% for those aged 80 years or older [19]. While no specific evidence is provided via this study, it is more than reasonable to think that individuals able to compete at an advanced sport level (masters athletes) could easily manage the physical demands associated with ADLs.

Should health care professionals prescribe advanced physical activity via masters level competition and its associated adherence to exercise? The authors forward the following response: "Combine the psychological, social, and health benefits of competing in masters sports with the advanced ability to perform ADLs (in the absence of chronic disorders) and one could argue that the quality of life has been shifted dramatically in the positive direction".

5. Conclusions

It is a commonly held conception that adherence to exercise improves indices of general health and well-being. For North American masters athletes competing at the Sydney WMG, it is shown that a key index of health, namely obesity as a health risk factor, is far lower in incidence for both male and female athletes when comparison is made to open age North Americans.

References

[1] Osmond, M., Coles, P., Elphinston, B., Ford-Eriksson, M., Jordan, C., Moore, J., Brettel, D., and O'Leary, S. 2009. *Sydney 2009 World Masters Games Final Report*. 2009 World Masters Games Organising Committee.

[2] DeBeliso, M., Adams, K., Climstein, M., Walsh, J., Burke, S., Heazlewood, I. T., and Kettunen, J. 2011. "World Masters Games: North American Participant Medical and Health History Survey." *Medicine & Science in Sports & Exercise* 43 (5): S374.

[3] Walsh, J., Climstein, M., Burke, S., Heazlewood, I. T., Adams, K., DeBeliso, M., and Kettunen, J. 2011. "Medical and Health Histories of Golden Oldies World Rugby Festival Participants." *Football Science* 8 (S1): 230.

[4] Adams, K., DeBeliso, M., Walsh, J., Burke, S., Heazlewood, I. T., Kettunen, J., and Climstein, M. 2011. "Motivations to Participate in Sport at the Sydney 2009 World Masters Games." *Medicine and Science in Sport & Exercise* 43 (5): S655.

[5] Walsh, J., Climstein, M., Heazlewood, I. T., Burke, S., Kettunen, J., Adams, K., and DeBeliso, M. 2011. "Variations in Body Mass Index with Age in Masters Athletes (World Masters Games)." *Journal of the World Academy of Science, Engineering and Technology* 7 (77): 1115-9.

[6] Walsh, J., Heazlewood, I. T., Climstein, M., Burke, S., Adams, K., DeBeliso, M., and Kettunen, J. 2011. "Body Mass Index for Australian Athletes Participating in Rugby Union, Soccer and Touch Football at the World Masters Games." *Journal of the World Academy of Science, Engineering and Technology* 7 (77): 1119-23.

[7] Climstein, M., Walsh, J., Heazlewood, I. T., DeBeliso, M., Adams, K., Burke, S., and Kettunen, J. 2012. "Obesity Prevalence in Master's Basketball Players." In *Proceedings of the 5th Exercise and Sports Science Australia Conference and the 7th Sports Dieticians Australia Update*, 114.

[8] World Health Organization. 2002. *Reducing Risks, Promoting Healthy Life*. The World Health Report 2002, 4, 60.

[9] Shields, M., Carroll, M., and Ogden, C. 2011. "Adult

Obesity Prevalence in Canada and the United States." US HHS CDC NCHS Data Brief No. 56. Accessed October 15, 2011. http://www.cdc.gov/nchs/data/databriefs/db56.pdf.

[10] Flegal, K., Caroll, M., Ogden, C., and Curtin, L. 2010. "Prevalence and Trends in Obesity among US Adults, 1999-2008." *Journal of the American Medical Association* 303 (3): 235-41.

[11] O'Brien, S. J., and Vertinsky, P. A. 1991. "Unfit Survivors: Exercise as a Resource for Aging Women." *The Gerontologist* 31 (3): 347-56.

[12] Paffenberger, R. S., Hyde, R. T., Wing, A. L., and Hsieh, C. 1986. "Physical Activity, All-Cause Mortality, and Longevity of College Alumni." *New England Journal of Medicine* 314: 605-13.

[13] O'Shea, J. P. 2000. *Quantum Strength Fitness II: Applied Strength Training and Conditioning for Peak Performance*. Corvallis, OR: Patrick's Books, 259-82.

[14] Walsh, J., Climstein, M., Heazlewood, I. T., DeBeliso, M., Kettunen, J., Adams, K. J., and Sevene, T. G. "Masters Athletes: No Evidence of Increased Incidence of Injury in Football Code Athletes." *Advances in Physical Education* 3 (1): 36-42.

[15] Eknoyan, G. 2008. "Adolphe Quetelet (1796-1874)—The Average Man and Indices of Obesity." *Nephrology Dialysis Transplantation* 23 (1): 47-51.

[16] Ode, J. J., Pivarnik, J. M., Reeves, M. J., and Knous, J. L. 2007. "Body Mass Index as a Predictor of Percent Fat in College Athletes and Nonathletes." *Medicine Science in Sports and Exercise* 39 (3): 403-9.

[17] Sevene, T. G., Adams, K. J., Climstein, M., Walsh, J., Heazlewood, I. T., DeBeliso, M., and Kettunen, J. 2012. "Are Masters Athletes Primarily Motivated by Intrinsic or Extrinsic Factors?" *Journal of Science and Medicine in Sport* 15 (6): S866.

[18] Guralnick, J. M., and Simonsick, E. M. 1993. "Physical Disability in Older Americans." *The Journal of Gerontology* 48: 3-10.

[19] U. S. Bureau of the Census, *Current Population Reports, Series* P23-194, *Population Profile of the United States: 1997*. U.S. Government Printing Office, Washington, DC, 1998.